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ON THE NATURE AND PROPERTIES OF TIMBER.

Extracted from "The Elementary principles of Carpentry," by Thomas Tredgold.

[Continued from Vol. II, page 149.]

Of the Prevention of the Ravages of Worms and Insects.

Besides the decay of its parts, timber is subject to be destroyed by various worms and insects. Some woods are more subject to be destroyed by them than others; such as alder, beech, birch, and, in general, all soft woods, of which the juices are of a saccharine nature.

Against the common worm, oil of spike is said to be an excellent remedy, and the oil of juniper, or of turpentine, will prevent them in some degree. A free use of linseed oil is a good preventive; but these can be applied to small articles only.

Evelyn recommends sulphur which has been immersed in aquafortis (nitric acid) and distilled to dryness, which being exposed to the air dissolves into an oil. The parts to be secured from the worm are to be anointed with this oil, which does not give an unpleasant odour to the wood.

Lime is an excellent preservative against the worm, and sap-wood should always be impregnated with it when used in a dry situation.

As worms do not attack bitter woods, soaking wood in an infusion of quassia has been tried, which is said to have the desired effect.

The bottoms of ships, and timbers exposed to the action of the sea, are often destroyed by the pipe-worm or *teredo navalis* of naturalists. This creature is very small when first excluded from the egg, but soon acquires a considerable size, being often three or four inches in

length, and sometimes increases to a foot in length. Its head is provided with a hard calcareous substance, which performs the office of an auger, and enables it to penetrate the hardest wood. When a piece of wood, constantly under water, is occupied by these worms, there is no sign of damage to be seen on the surface, nor are the worms visible till the outer part of the wood be broken or cut away; yet they lie so near the surface as to have an easy communication with the water by a multitude of minute perforations. They were originally brought from India to Europe.

Wood is eaten by them till it becomes like a honeycomb, yet there is an evident care in these creatures never to injure one another's habitations, for the divisions between the worm holes are entire, though often extremely thin. The fir and alder are the two kinds of wood they seem to destroy with the greatest ease, and in these they grow to the greatest size. In oak they make slower progress, and appear smaller, and not so well nourished.

They never touch bitter woods, and in solid or hard woods they make slow progress. Charring the surface of wood is not found to be of any use.

A mixture of lime, sulphur, and colocynth, with pitch, is found to be a protection to boards and the like. And rubbing the wood with poisonous ointments is a means of destroying them.

Coal tar is also a good protection against their depredations. The pores of the wood should be saturated as far as possible with it; and perhaps corrosive sublimate might be used with advantage, by saturating the wood with a solution of it, and letting it dry before the tar be laid on.

Whale oil is stated to be an effectual remedy, and has been successfully employed.

There is another kind of worm which is very destructive to timber, which Mr. Smeaton observed in Bridlington piers. The wood of these piers, he says, is destroyed by a certain species of worm, differing from the common worm whereby ships are destroyed. "This worm appears as a small white soft substance, much like a maggot; so small as not to be seen distinctly without a magnifying glass, and even then a distinction of its parts is not easily made out. It does not attempt to make its way through the wood longitudinally, or along the grain, as is the case with the common ship worm, but directly, or rather a little obliquely inward. They do not appear to make their way by means of any hard tools or instruments, but rather by some species of dissolvent liquor, furnished by the juices of the animal itself. The rate of progression," he was informed, "is, that a three-inch oak plank will be destroyed in eight years by action from the outside only." Fir is more subject to be destroyed by this worm than oak.

To prevent the destructive effects of these worms, Mr. Smeaton recommended that the timbers of the piers should be squared, and made to fit as close together as possible; to fill all the openings left with tar and oakum, and level the face and cover it with sheathing, as ships are covered.

These worms do not live except where they have the action of the water almost every tide; nor do they live in the parts covered with sand.

The remedies that resist the ship worm would no doubt be effectual against these.

The termite or white ant (a species of the genus *termes*, and of the aptera order of insects in the Linnæan system) is represented by Linnæus as the greatest calamity of both Indies, because of the havoc they make in all buildings of wood, in utensils, and in furniture; nothing but metal or stone can escape their destructive jaws. They frequently construct nests within the roofs and other parts of houses, which they destroy if not speedily extirpated. The larger species enter under the foundations of houses, making their way through the floors, and up the posts of buildings, destroying all before them. And so little is seen of their operations, that a well-painted building is sometimes found to be a mere shell.

Corrosive sublimate is highly poisonous to these ants; therefore, to impregnate the timber with a solution of it would prevent their ravages. Arsenic is also very destructive to them; and they do not destroy wood impregnated with oil, particularly essential oils. Thunberg found cajeput oil effectual in destroying the red ants of Batavia; he used it to preserve his boxes of specimens from them. When ants were put into a box anointed with this oil they died in a few minutes.

Of the Durability of Timber.

The carpenter who feels any delight in the progress of his art cannot be insensible to the advantage of giving durability to his materials; nor yet be uninterested in any inquiry into the probable extent of their duration. Not that his fame as an artist rests solely on the extent of their duration; for while his productions are worthy of imitation, the remembrance of them will be preserved by the engraver's art as long as there shall be men capable of paying a just tribute to the memory of departed merit. The French army, in 1799, destroyed the celebrated bridge across the Rhine at Schaffhausen; but the fame of Grubenmann the carpenter will long continue; and the form of that excellent specimen of the art will only cease to be remembered when carpentry itself no longer exists.

It must also be remembered, that to give durability to his materials is one branch of the carpenter's art; and that to be defective in this particular is as much to his discredit, as to be unacquainted with the geometrical or mechanical principles of carpentry.

As examples of the duration of timber, I have collected the following notices; and must, though not without regret, leave the subject to be extended by those who have better means of rendering it more complete.

Of the durability of timber in a wet state, the piles of the bridge built by the Emperor Trajan across the Danube is an example. One of these piles was taken up, and found to be petrified to the depth of three-fourths of an inch; but the rest of the wood was little different

from its ordinary state, though it had been driven more than sixteen centuries.

The piles under the piers of London Bridge have been driven above 600 years, and from Mr. Dance's observations, in 1746, it does not appear that they were materially decayed; indeed they are now (1819) sufficiently sound to support the massy superstructure. They are chiefly of elm.

We have also some remarkable instances of the durability of timber when buried in the ground. Several ancient canoes have been found in cutting drains through the fens in Lincolnshire, which must have lain there for many ages. In the Journal of Science, &c. published at the Royal Institution, one of these canoes is described, which was found at the depth of eight feet below the surface of the ground. It was 30 feet 8 inches long, and 3 feet wide in the widest part, and appears to have been hollowed out of an oak tree of remarkably fine free-grained timber.

Also, in digging away the foundation of old Savoy Palace, London, which was built 650 years ago, the whole of the piles, consisting of oak, elm, beech, and chesnut, were found in a state of perfect soundness; as also was the planking which covered the pile-heads. Some of the beech, however, after being exposed to the air a few weeks, though under cover, had a coating of fungus spread over its surface.

On opening one of the tombs at Thebes, M. Belzoni discovered two statues of wood, a little larger than life, and in good preservation; the only decayed parts being the sockets to receive the eyes. The wood of these statues is most probably the oldest in existence that bears the traces of human labour.

A continued range or curb of timber was discovered in pulling down a part of the Keep of Tunbridge Castle, in Kent, which was built about 700 years ago. This curb had been built into the middle of the thickness of the wall, and was no doubt intended to prevent the settlements likely to happen in such heavy piles of building; and therefore is an interesting fact in the history of constructive architecture, as well as an instance of the durability of timber.

In digging for the foundations of the present house at Ditton Park, near Windsor, the timbers of a drawbridge were discovered about ten feet below the surface of the ground; these timbers were sound, but had become black. Hakewell says, that Sir John de Molines obtained liberty to fortify the Manor-house of Ditton, in 1396; and it is most probable the drawbridge was erected soon after that time; and accordingly the timber had been there about 400 years.

The durability of the framed timbers of buildings is also very considerable. The trusses of the old part of the roof of the Basilica of St. Paul at Rome, were framed in 816, and were sound and good in 1814, a space of nearly a thousand years. These trusses are of fir.

The timber-work of the external domes of the church of St. Mark, at Venice, is more than 800 years old, and is still in a good state.

The inner roof of the Chapel of St. Nicholas, King's Lynn, Norfolk, is of oak, and was constructed about 450 years ago.

Daviller states, as an instance of the durability of fir, that the large dormitory of the Jacobins' Convent, at Paris, had been executed in fir, and lasted 400 years.

The timber roof of Crosby Hall, in London, was executed about 360 years ago; and the roof of Westminster Hall, which is supposed to be of chesnut, is now above 300 years old.

The rich carvings, in oak, which ornamented the ceiling of the king's room in Stirling Castle, are many of them still in good preservation. It is nearly 300 years since they were executed, and they remained in their original situation till a part of the roof gave way, in 1777, when the whole was removed, and has since been dispersed among the collectors of curious relics of old times.

Moreton Hall, in Cheshire, where "the staircase winds round the trunk of an immense oak tree," and the building itself is chiefly constructed of wood, has now existed 250 years.

And Mr. Britton describes an old house at Islington, constructed chiefly of wood, which he has ascertained to be about 200 years old.

Other notices of extraordinary durability will be found in the descriptions of the different kinds of wood. But enough already has been collected to show that timber is very durable where nothing more than ordinary means have been used to render it so; that is, nothing more than judicious selection and good seasoning.

Every permanent support should be a good and sound piece of timber; inferior kinds should be used for temporary purposes, and where no strain occurs, and consequently where they can be easily renewed without injury to the strength of the building.

Mr. Barrow, in writing on this subject, very judiciously remarks, "that the felling of timber while young and full of vigour, making use of the sap-wood, and applying it to ships and buildings in an unseasoned state, have no doubt contributed to make the disease of dry rot infinitely more common and extensive than it was in former times, when our ships were 'hearts of oak,' and when in our large mansions, the wind was suffered to blow freely through them, and a current of air to circulate through the wide space left between the pannelled wainscot and the wall. In those old mansions which yet remain, and in the ancient cathedrals and churches, we find nothing like dry rot, though perhaps

> ..... 'perforated sore
> And drilled in holes, the solid oak is found
> By worms voracious eaten through and through.'"

In regard to the durability of different woods, the most odoriferous kinds are generally esteemed the most durable; also woods of a close and compact texture are generally more durable than those that are open and porous; but there are exceptions, as the wood of the evergreen oak is more compact than that of the common oak, but not near so durable.

In the same kind of wood there is much difference in the durability; and the observation is as old as Pliny, "that the timber of those trees which grow in moist and shady places is not so good as that

which comes from a more exposed situation, nor is it so close, substantial, and durable;" and Vitruvius has made similar observations.

Also split timber is more durable than sawn timber, for in splitting, the fissure follows the grain, and leaves it whole, whereas the saw divides the fibres, and moisture finds more ready access to the internal parts of the wood. Split timber is also stronger than sawn timber, because the fibres being continuous, they resist by means of their longitudinal strength; but when divided by the saw, the resistance often depends upon the lateral cohesion of the fibres, which is in some woods only one-twentieth of the direct cohesion of the same fibres. For the same reason whole trees are stronger than specimens, unless the specimens be selected of a straight grain, but the difference in large scantlings is so small as not to be deserving of notice in practice.

[To be continued.]

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*On the preparation of Gold Beaters' Skin, Lathe-Bands, Catgut, Strings for Harps, Violins, and other Musical Instruments, &c.**

These various arts all require the previous freeing of the *muscular tunic* from the other membranes which constitute the gut. Anatomists distinguish in it, three membranes; viz. the external one, termed the *peritoneal;* the middle one, or *muscular* membrane; and the internal or *mucous* membrane. Formerly, the guts were subjected to the putrid fermentation, in order to separate the peritoneal and mucous membranes from the muscular one; and this process was accompanied with such a fœtid effluvia, that the authorities obliged the manufacturers to establish their works at a distance from all other habitations. In 1820, the Prefect of Police, of Paris, proposed to the *Société d'Encouragement*, to offer a prize for a process, either chemical or mechanical, of effecting this object without submitting the guts to the putrid fermentation. The writer had the happiness to fulfil this object, and to merit the premium offered.

After the guts have been freed from all greasiness, by the usual methods, and turned inside-out, they are to be put into a tub, capable of containing as many as are produced from 50 oxen; and two buckets of water, each containing a pound and a half of the *eau-de-Javelle*† (marking from 12 to 13 degrees of the *Pèse-liqueur*, or areometer for alkaline solutions,) are to be poured upon them. If they should not be sufficiently wetted, throw over them another bucket-full of well or river water; they are then to be well stirred up, and left to steep all night. At the end of this time, the mucous membrane may be removed with as much facility as it could be after many days of putrid fermentation. At the moment of contact with the *eau-de-Javelle*, all fetidity totally disappears.

* From the *Dictionnaire Technologique.*

† This article is an alkaline liquid, manufactured in the vicinity of Paris, and sold at a cheap rate, for the use of laundresses, &c. Of this liquid we will give a further account, at the close of this paper.

The other operations may be afterwards performed in the usual manner.

On the preparation of Gold Beaters' Skin.

When the workman has stripped off that part of the peritoneal membrane which surrounds the *cæcum*, he takes from 2 to 2½ feet in length of it, and inverts it, or turns it inside-out; he then leaves it to dry: when dry, it resembles a pack-thread. In this state it is sold to the manufacturer of gold-beater's skin; who takes the dried membranes, and soaks them in a very weak solution of potash. When sufficiently soaked, so as to have become gelatinous, he places them on a wooden plank to scrape them clean and cut them open with a knife. When the pellicles are well cleansed, and sufficiently freed from the water, they are extended on wooden frames, three or four feet long, and about ten inches wide; these are formed of two uprights, joined by two cross-pieces; the cross-pieces have grooves of three or four lines wide made in them.

In order to extend the membrane, the workman takes it in his hands, and affixes one end of it, by its glutinous quality, to the top of the frame, taking care that that part of the intestine which formed the outside of it be placed next to the frame; he then extends it every way, and causes it to adhere to the other end of the frame: this effected he takes another membrane, and applies it upon that which is already extended, taking care that the muscular membranes should be in contact with each other: in this way, they become so perfectly glued together, as to form one solid body.

The two membranes soon become dry, except at their extremities, which are glued to the cross-bars of the frame. When the whole is well dried, the workman cuts the pellicles across at each end with a good knife, and separates them from the frame. The dried and stretched membranes are then delivered to another workman, to give them what is termed *le fond*, being the last preparation; and to cut them into convenient sizes.

In order to finish the pellicles, the workman takes each band separately, and glues it on a similar frame to that which we have before described, but without a groove: he applies the glue upon the edges of the frame, and places on it the band of pellicle. When quite dry, it is washed over with a solution of one ounce of alum, dissolved in two wine-quarts of water, and again allowed to dry; it is then coated, by means of a sponge, with a concentrated solution of isinglass in white wine, in which acrid and aromatic substances have been steeped, such as cloves, musk, ginger, camphor, &c.: these last substances are added, to prevent insects from attacking the pellicle. When sufficiently coated with this composition, or, as the workmen call it, *grounded*, they, lastly, cover it with a layer of whites of eggs. The pellicle is then cut into pieces of about five inches square; submitted to the action of a press, to flatten them; and then formed into small packets or books for sale to the gold-beaters. This last process very much resembles that used in preparing the English Court-Plaster, or *le taffetas d'Angleterre*.

On the preparation of Lathe Bands.

Before we make known the preparation of the intestines of sheep, for the manufacture of various kinds of cords, we shall mention that of those made of the horse, mule, or ass, called *Lorrains*, for lathe-bands. These intestines receive exactly the same preparatory treatment as those of the ox.

Grinders, polishers, and various other mechanics, use bands or cords, manufactured from the intestines of the horse, &c. freed from the mucous membrane. The gut is taken hold of by one end; into which is thrust a wooden ball, fastened on the end of a stake, fixed in a block; below this ball are four cutting-blades; or, to render the explanation more clear, it is a cutter formed of four blades and surmounted by a wooden ball: they draw down the intestine equally over these blades, with both hands, so as to cut it into four equal strips. They take four, six, or eight of these strips, accordingly as they wish the cord to be thicker or thinner; then tie these strips by a particular kind of knot at one end, with large twine, made on purpose, which they call a lace; and pass the end of it over a peg secured in a hole made in a post strongly fixed: at the distance of about 30 feet, is placed another post with pegs, on one of which they pass these strips: near to the first post, the strips are all tied together with a new lace, which they fasten to the peg whereof we have just spoken; the workmen call this first operation the "warping." They cut these strips, and fasten them as above described, if they are long enough (which is generally the case,) being careful that the ends are always taken in with the thread, having cut them previously across, so that the seam shall not form any unequal thickness. If they are long enough, they make a second length, till the gut is all taken in, or the pegs entirely filled.

When the weft is finished, the workman places his wheel conveniently, and passes over the hook of the spindle the thread which holds the weft-cord: he puts on a second lace, if the wheel be strong enough to bear it; gives several turns to the wheel by means of a handle; and places the already-twisted cord over a hook. He acts the same with every woven cord; passing his hand carefully along the cord from the wheel, and cutting with his knife all those fibres or threads which will not form one body with the cord. This never shortens in drying provided it is always gathered together at the same dimension over the pegs. Some hours having elapsed, they replace the cords upon the wheel, and twist them afresh: 12 or 15 hours afterwards they take them one after the other, and fasten the lace to a peg which they turn with the hand; the wheel seldom being strong enough. This twisting being effected, they rub it with a horse-hair cord dipped in water, which they form into a bundle, and hold between their hands. This operation is called "stretching." Another twisting is made three hours afterwards; and they stretch it as forcibly as possible, after again fixing the cords over the pegs, and to the posts.

If the cord, when sufficiently dry and twisted, is not exactly even, they polish it with a piece of dog-fish-skin; but if the horse-hair cord

has been passed enough over it, that becomes unnecessary. When the cord is dried and stretched, it is not generally sulphured. When perfectly dry, they cut the two ends near to the lace, and coil it into a ring for sale.

The instant that the workman who makes these cords receives the intestines, he is obliged to wash them, to turn them inside-out, and to steep them in a barrel, containing two pails of water, mixed with a pound of *eau-de-Javelle*, of the strength we have before noticed.—This quantity will serve for 15 or 20 intestines, and only increases the expense to the manufacturer, for this number, about ten centimes. On the morrow, he separates the mucous membrane, by the ordinary means; washes the guts in a large tub of water, cuts them into strips, puts the laces round them during the day, and gives them the first twist: the next day he finishes them.

If the cords are sufficiently dry by the next day, he is obliged, for the sake of salubrity, to repeat the operations. After this, the fœtid odour is no longer perceptible, and he may finish the cords at leisure.

On the improved distillation of Aromatic Plants, and particularly of Orange Flowers, by M. CADET-DE-VAUX, *and the late* WILLIAM LEWIS, M. D.

ALTHOUGH the progress of chemical knowledge is constantly destroying so many vulgar errors, still there are objects to be brought to perfection, which are interesting both to science and medicine.

Chemistry has recently extracted the vegetable substances *quinquina* and *ipecacuanha*, both strong poisons; but has neglected the improvement of many products in pharmacy, such as the distillation of the aromatic plants; and particularly of orange-flower water, which is still esteemed and retained amongst the empiric remedies.

If the distiller be asked how this water is to be drawn, he will reply, by putting the flowers into the still with a pailful of water, and submitting them, for a longer or shorter time, to a boiling heat; that the first product constitutes the double orange-flower water; and that the second product is a water which is quickly spoiled by keeping.

The following is the process, that, taught by science and experience, I have substituted for the faulty process prescribed in all the formularies. The superior quality of the product, as well as the simplicity of the process, it must be admitted, gives it a decided superiority. This is acknowledged by M. Vauquelin Nasaurion, Apothecary, rue Poissonnière. It consists merely in suspending in the body of the still, in the steam of the boiling water, a piece of flat wicker-work, or a metallic cloth, covered with the orange-flowers in a pyramidal form. This description does not require any further explanation. We may easily perceive, that the distillation need only be suspended, in order to empty the still of its refuse; and to put in fresh flowers and boil-

ing water, which may again be removed in about a quarter of an hour.

I have just compared the orange-flower water of this year with that of the two preceding years; and cannot perceive any difference between them. Such, then, is this very simple practice; and it is truly surprising that such a number of years, even of ages, should have passed without attaining the same end, with a simplicity which is indeed perfection. A. A. CADET-DE-VAUX.

Remarks by the Editor of the Technical Repository.—M. Cadet-de-Vaux is not so original in his discovery as he seems to imagine. In that excellent work, "*Newmann's Chemistry*," translated by the late scientific Dr. William Lewis, we find the following note by Dr. Lewis, "*On distillation in the water-bath.*" It has been commonly supposed that a heat much less than that of a water-bath is sufficient to elevate the fragrant part of vegetables; that all those plants which diffuse their active effluvia through the open air, will give out the same effluvia when inclosed in close vessels, and exposed to a heat no greater than that of the atmosphere in summer.

"Take (says the celebrated *Boerhaave*) rosemary, fresh gathered in its perfection, with the morning-dew upon it, and lay it lightly and unbruised within our little cylindrical furnace. Then cover the furnace with its large conical still-head, and apply a glass-receiver to the nose thereof. In the fire-place of the furnace put a lighted coal (i. e. charcoal) that does not smoke, and raise up an equal degree of heat, not exceeding eighty-five degrees on Fahrenheit's thermometer; and let this heat be kept up so long as any liquor comes over. This water contains the elementary water or presiding spirit of the plant; a spirit small in bulk, but rich in virtue, and exhibiting the specific smell, and taste, and particular virtue of the subject; leaving the remainder exhausted. Hence we may understand, that the various, peculiar, and often surprising virtues of plants may be widely diffused through the air, &c."

I have submitted to this process, rosemary and other aromatic herbs, without the promised success: the distilled liquors in general had hardly any thing of the fine flavours of the subject: even when the heat of boiling water was made use of, there were few plants that gave over to the distilled liquor any considerable smell or taste. It is by the assistance of free ventilation in the open air, that the sun's heat robs odoriferous plants of their fragrance; and even when thus assisted, it leaves their other active virtues unhurt: these, also, the humid air of the mornings and evenings dissolves and imbibes.

Hence the different effects, upon animal bodies, of the natural effluvia of the aerial infusions of certain vegetables, from those of their distilled waters. Damask-roses, in drying, impregnate the air of the room with their laxative virtue; and red-rose buds, in like manner, give out their astringency; virtues which never arise in distillation, but which common water and spirit extract readily by infusion. The author above quoted mentions some examples of this kind, without seeming to have duly attended to their consequences: for if the shade

of the walnut-tree make the body costive, and the effluvia of poppies procure sleep, as these virtues are incapable of being elevated in distillation, does it not follow that they must be communicated to the air upon some other principle?

With regard to the use of a water-bath, though there are few vegetables that give over their flavour in that degree of heat, yet, for those that do, it is undoubtedly of great advantage: fire sensibly injures, in proportion to its degree, the flavour of aromatic herbs; and those which are most volatile suffer the most from it. Some tender flowers, as those of rosemary, have their fragrance impaired by the bare mechanic action of watery or spirituous liquors, independently of heat, nearly as much as by bruising them.

In distilling these kinds of subjects, I have varied the process, by applying, instead of water or spirit in their gross form, only their vapours: the liquor being poured into a still, a hair-cloth, stretched on an iron hoop, is let in above it, and on this the fresh unbruised flowers are lightly spread: the vapour, into which the liquor is resolved by the heat of a water-bath, passing gently through the flowers, imbibes their fragrance unimpaired, and condenses into a water or spirit greatly superior to those prepared in the common manner.

The foregoing observations point out a method of improving also the preparation of extracts. If infusions of mint, balm, and sundry other vegetables of the aromatic kind, be distilled by a gentle warmth in close vessels, little more than the watery menstruum will arise, the greatest part of the flavour of the subject remaining behind in the extract. When the distillation is performed by a boiling heat, the whole of the flavour comes over with the water; and when the inspissation is performed in open vessels, however gently, it is almost wholly absorbed and carried off by the air. Our author himself (Newmann) seems to have been sensible of this, in his experiments on tea; for, in order to procure an extract from tea, possessing the admired flavour of the leaf, he finds it particularly necessary to inspissate the infusion, without communication with the open air.

Thus we see, that by distilling many odoriferous vegetables in close vessels, we may either obtain their fragrance in the water that distils, or retain it, in great measure, in the extract, according as the degree of heat made use of, is strong, or gentle;—and that by evaporating them in open vessels, their fragrance is carried off by the air.

On making *Distilled Waters stronger by Cohobation.*—This is another of the many processes, in which I have, on trial, been greatly disappointed. Though some of the chemists affirm, that distilled waters in general may be rendered, by repeated cohobations, of any assignable degree of strength, and their virtues exalted without limitation, I have not found that the repetitions of these operations make any considerable addition to the strength even of those waters whose exaltation has been specifically specified.

The distilled waters of mint, rosemary, and other aromatic herbs, being re-distilled a number of times successively, from fresh parcels of the respective subjects; instead of being more and more exalted and improved, they were, on every repetition, more and more debased. Some of them indeed, by one cohobation, seemed to be rather

mended, and sometimes a second did hardly any injury; but after this period, they all received an ungrateful taint from the repeated action of the fire, without gaining any more of the flavour of the subject than they had at first.

It is not by distillation, but by infusion, that water can be unlimitedly impregnated with any of the principles of plants. Water extracts, by infusion, the gummy parts of vegetables; and it is a property of all gummy substances to dissolve indefinitely in water; that is, to unite with any proportion of it, small or large, and render the liquor thicker and thicker, as the quantity of gummy matter is increased. When resins or essential oils are intimately combined with gums, as they are in most vegetables, these compounds also unite indefinitely with water.

Hence, by macerating or infusing, in the same water, fresh parcels of aromatic herbs, the liquor takes up more and more of the soluble parts, till it grows too thick to be poured off, and the loss of fluidity is the only limit to impregnation.

In distillation, on the other hand, nothing arises with the water, but the essential oil; and from the pure essential oils this fluid extracts only a limited quantity. Salts are, in this respect, somewhat analogous to oils: when a certain quantity of salt is dissolved in water, the liquor, though thin and fluid as at first, will take up no more. By the application of heat, it may be made to dissolve a larger quantity than in the cold; but all that is so dissolved will be separated and thrown out again, upon an abatement of the heat. Thus, when essential oils are coagitated with water by a boiling heat, and elevated along with it in the form of vapour, the water condensing again, keeps a part of the oil dissolved, and throws out the rest. The water is now saturated; and it is in vain to endeavour, by any repetitions of the distillation, to make it imbibe more.

Hence the use of employing the water that arises in the distillation of essential oils for subsequent distillation of the oil of the same subject: being saturated with oil in the first distillation, it dissolves none of that which arises with it in the others; and thus the produce of oil proves proportionably larger than if fresh water was taken.

It follows from this account, that there is one case in which cohobation may be of some service; that when the water is not fully saturated in the first distillation, it may be made to imbibe more, by a repetition of it. But surely it is more adviseable to use the plant in such quantity as may give a sufficient impregnation at once, than to endanger debasing the flavour which the liquor has once received, by communicating more.

ESSAYS ON BLEACHING.

By James Rennie, A. M. Lecturer on Philosophy, &c. &c. London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION I.—*Continued.*

THE qualities of water are not of difficult determination, although a chemical analysis of them is none of the least difficult problems in

chemistry. When water is nearly pure, (for no native water is entirely so,) it is colourless and transparent; has no smell, and scarcely any taste. If water have these qualities, it may be pronounced good, without farther trial. If it is wished to examine it more minutely, its specific gravity must be taken, which should not much exceed that of rain or distilled water; indeed, the lighter it is the better. Its hardness may be tried by pouring half an English pint or so into a glass tumbler, into which has been previously put a thin slice of Spanish soap, and allowing it to stand for half an hour. If it contains, in solution, any metallic or earthy salts, the soap will be decomposed, and become ropy, and curdled. If it be soft, on the other hand, it will be somewhat whitened, but the whiteness will be equally diffused through the whole. Or if it is required to try water instantly, it can be done by a test made by dissolving a little Venice soap in alcohol. The salts of lime, the most common earth which is to be found in water, are easily discovered by the copious white precipitate which they afford, when treated with oxalate of ammonia. Iron may be at once detected, by dropping into the water a small quantity of prussiate of potass, or tincture of galls. If iron be present, the prussiate will produce a blue colour in the water; the tincture will first produce a purple, which will afterwards change to a black. Sulphate of iron, the most common state in which it occurs in our waters, may be discovered by nitrate of barytes, which, in this case, gives a yellow precipitate. On this principle, the importance there is in the choice of water for bleachers may be strikingly illustrated. Take half a pint of distilled water, add to it a single drop of solution of the sulphate of iron, and a single drop of the tincture of galls, and stir it with a glass rod. It will now present but a very slight change of colour, but add to it half a pint of spring water, and the whole will become instantly black. I have not left room to detail the mode of finding, by analysis, the proportions of substances contaminating water; for this I refer to Thomson's Chem. IV. 212.

I shall conclude the subject of water, by mentioning some of the expedients by which such as may be unfit for the bleacher's use may be improved. I formerly remarked that hard waters have a considerable power of checking the putrefactive fermentation. Now, this holds equally *vice versa*, and can easily be turned to good account in rendering hard waters soft, for abundance of waste vegetables can at all times be easily procured. It is this that renders soft the waters of most lakes, and rivers arising from lakes; for, as they abound in aquatic plants, which are continually destroyed and re-produced, a great quantity of vegetable matter runs into fermentation, and softens the water. The effect may be accounted for by the combination of the ammonia and sulphuretted hydrogen arising from the decomposed vegetables, with the earthy and metallic salts which are contained in the water, and render it hard. Dr. Priestly, vol. II. p. 185 of his Experiments on Air, has related a fact strongly illustrative of what we here recommend. He there states on the authority of Mr. Garrick, that the public reservoirs at Harwick are commonly very foul on their sides and bottoms, but contain water which is both wholesome

and pleasant, provided that they are *not cleaned*, for whenever the fæcula, together with the mosses and other aquatic vegetables, are removed by cleaning, the water becomes totally unfit for use till these matters again accumulate in sufficient quantity to purify them. Plants even seem to purify water while *growing* in it; a fact, for the knowledge of which we are indebted to Priestly and Ingenhouz. This seems to be particularly the case with the byssi and confervæ, which fortunately abound in all our waters, unless pains be taken to prevent their growth, under a false notion of cleanliness. (See Priestly on Air.)

Water containing lime may be improved by exposing it in shallow reservoirs to the action of the atmosphere; in which case the carbonic acid of the air unites with the lime, and precipitates it, or causes it to float on the surface. When such water is to be used for any nicer purpose, such as for diluting acids, it may be improved by the method employed by dyers. Put twenty-four bushels of bran into a tub or vat which will contain about ten hogsheads; fill a large boiler, with the hard water, which, when just ready to boil, pour into the vat. The acid fermentation will soon commence, and in twenty-four hours it will be ready for use. Berthollet conceives that the acid acts by decomposing the carbonate of lime and magnesia, from which, its acid, being more powerful, disengages the carbonic acid; and that in this way the earthy sediment which is occasioned by boiling is prevented from taking place. (Edin. Encycl. art. Dying.)

When water is rendered hard by the presence of sulphate of lime, it may be purified at a comparatively small expense, by a solution of barytes, for the sulphuric acid having a greater affinity for the barytes than for the lime, will leave the latter to unite with the former.* The solution should be dropped in by degrees, in small portions, till it produces no farther precipitate. If too much should happen to be put in, and this will be shown by its giving a vinous colour to paper stained as Brazil wood or Fernambouc, (Ann. Chem. XXIX, page 321.) it may be readily precipitated by exposure to the atmosphere, whence it will draw carbonic acid, and form a carbonate. When barytes is not to be had, hard water may be softened by the addition of pearl ash or crystals of soda, either of which will combine with the sulphuric acid, and disengage the lime, but not so perfectly as the barytes; besides, the expense of the purification would exceed the advantage derived from it. A cheaper substitute, however, may be found in stale urine, which may be gradually poured into the water till the object is attained. Its offensive odour may be corrected by the previous addition of quick-lime, a mode of sweetening which does not seem to have been known to the Romans, who obliged their scourers to reside in unfrequented parts of their cities. (Plin. Hist. Nat. XXVIII. 5, 6. Parkes.)

The solutions of iron which occur in our waters, are generally sulphates, and are most injurious in every part of the process of bleaching. Water so contaminated must be drawn into a cistern and puri-

* See Nich. Journ. I. 535. The mode of preparing this solution is given by M. Robinquet in the sixty-second tome of the Annales de Chimie.

fied as in the last case, by adding a solution of pure barytes, which will deprive the iron of its solvent, when it will consequently precipitate. The process takes several hours, but when expedition is required two reservoirs may be constructed, and the process may be commencing in the one, while it is finishing in the other. The workmen, however, ought to be cautious of adding too much of the solution, as, in this way, the water may be left in as bad a state as at first. If the cisterns, however, are made sufficiently shallow, exposure to the air will throw the superabundant barytes to the bottom. Mr. Parkes has ingeniously suggested that, in works in which large steam engines are employed, a considerable quantity of distilled water might always be commanded from the waste steam. "It would only require," he remarks, "a proper receptacle to condense it, and its advantage to the bleacher of fine calicoes for printing would be incalculable." I would add to this ingenious, and evidently practicable suggestion, that although the quantity produced in this way was not very considerable, even a small quantity of pure water produced daily, and *added* to the common water in use, would greatly increase its purity by diluting the contaminating substances.

After all, these expedients are but imperfect, and, in every case, expensive and troublesome. The manufacturer, therefore, cannot be too strongly impressed with the importance of forming his establishment where none of them are necessary—where he may have a constant and copious supply of good soft water.

Section II.—*Of the vegetable Alkali.*—There is nothing in which the mere manufacturer who is not a chemist is more at a loss than in ascertaining the quality of his alkali; in discovering the proportions of efficient material in a given quantity of the alkali of commerce. To the chemist, however, it is not a task of insuperable difficulty; and he, therefore, ought to lend all the aid in his power to simplify the process of analysis.

The vegetable alkali of commerce possesses very different qualities, according to the manner in which it is manufactured, and the vegetables from which it is procured. This substance may be extracted in greater or less quantity by lixiviation from the ashes of almost all vegetables, and pre-exists in plants previous to combustion, not indeed in a separate uncombined state, but united with the sulphuric and muriatic acids, and sometimes the nitric, but more commonly with a vegetable acid, or in oil in the state of a neutral salt. These salts seem to be decomposed during combustion, (their own carbon probably acting as a powerful agent,) and the alkaline part is thus set free. When the sulphuric acid is a part of the compound, the combustion sets free its oxygen, and sulphur is produced, which unites with the now disengaged alkali and forms a sulphuret. This substance, Mr. Kirwan says, (Trans. R. Ir. Acad. 1789,) is more readily produced when free access to the air during combustion has not been given. Formerly the potash and pearl ash of commerce were supposed to be pure simple substances. In 1756, Dr. Black proved satisfactorily that they *all* contain a large proportion of car-

bonic acid. This may be shown by a very simple experiment. Pour a little of the clear solution of carbonate of potash in a glass of transparent lime-water, when the lime will be instantly converted into chalk by abstracting carbonic acid from the potash. M. Descroizilles found that American pearl ash consists of a mixture of caustic soda and muriate of potash. (Ann. de Chim. LX. 17.)

This alkali is procured from North America, Russia, and other countries which abound much in forests; and is manufactured by incinerating and lixiviating the wood which is cut down in order to clear the land for cultivation. The pot and pearl ashes of commerce, which differ in the latter being milder in consequence of a superabundance of carbonic acid, are brought to market of three different qualities, but the manufacturer would fall into a gross mistake were he to suppose that those of the first quality, for example, contained a uniform quantity of pure alkali; this can only be learned by the actual analysis of a specimen taken from every parcel he may have occasion to purchase. At the very commencement of the examination of a parcel of ashes by the eye, the bleacher ignorant of chemistry is often much deceived in the estimate he forms of their quality; for, by following an unlucky prejudice, he prefers that which exhibits a red fracture, which can only be occasioned by oxide of iron, or by sulphur. Now, either of these substances, every bleacher knows, will greatly injure the cloth in every stage of the process. In order to humour this hurtful prejudice, some of the manufacturers of alkali in England adulterate with sulphur, to produce this red fracture, and procure a reputation for their goods. By this means, the bleacher is not only induced to give a high price for an inferior commodity, but before he can employ such alkali in any of the nicer operations of his art, he must get clear of the sulphur and the neutral salts which it may have formed. Even the best ashes never contain above 70 per cent. of alkali in a state of purity, and seldom more than 60 or 65. Of the adulterating substances, charcoal is perhaps the most common; but as it commonly exists under its proper appearance, it can readily be recognized by the eye. Water is always present in the proportion of about 5 or 6 per cent. The rest of the foreign substances commonly consist of carbonic acid, sulphate and muriate of potash, and muriate of soda. The last of these is often added by the seller for the purpose of increasing the weight, especially to those which are contained in the casks marked of the second and third qualities. M. Descroizilles informs us that the casks and packages are not always of the same quality in their different points and various pieces; for the ends of a cask and its centre towards the bung, have been found to contain good potash, while the other parts were either of inferior quality, or, what was worse, contained nothing but earth. (Ann. de Chim. LX.)

Several methods have been proposed by eminent chemists for ascertaining the proportion of efficient alkali in the ashes of commerce. If it be required to ascertain whether any lime exists in a parcel of ashes, dissolve an ounce of them in boiling water, and put into the

vessel a single drop of the oxymuriate of mercury; if lime be present, a yellowish brown colour will be produced. (Kirwan.)

Mr. Kirwan (Trans. R. I. A. 1789, p. 15) recommends one founded on the principles that a hot solution of a free alkali, or one combined only with carbonic acid gas or sulphur, can hold no earthy or metallic neutral salt in solution; that alumina cannot be precipitated by the hot solutions of any alkaline neutral salt, but only by free alkali, or such as contains sulphur or carbonic acid gas; that any carbonic acid gas taken up by the alumina, is separated in drying, or may be disengaged by the muriatic acid, and that the strength of an alkali is in proportion to the quantity of any acid required for its saturation. For the analysis, then, procure a pound of alum, reduce it to powder, wash it with cold water, put it into a tea-pot, and pour on three or four pounds of boiling water. Powder an ounce of the alkali to be tried, put it into a Florence flask, with a pound of distilled water, (which the bleacher can have from his steam engine,) boil the liquid for an hour, and filter it. Both this and the solution of alum being heated gradually, pour in the latter till the liquor reddens litmus paper. Dry the substance which is obtained by filtering this solution, reduce it to powder, and keep it in a heat of 500° for a quarter of an hour. Place in the same scale of a balance with this, after weighing it alone, an ounce flask filled with muriatic acid, and balance them by weights on the opposite scale; mix the alkali and the acid, blow into the vessel, to expel the carbonic acid gas which may have accumulated, (see Nich. 4to Journ. I. 271,) and mark how much it takes to restore the equilibrium. This, subtracted from the weight of the dry alkali, will leave as a remainder, a weight exactly proportioned to the weight of pure alkali contained in an ounce of ashes; all besides, is foreign matter. This, however, is liable to some inaccuracies, for if quick-lime be present, it will decompose the alum. Whether this be the case, can be discovered by the oxymuriate of mercury, or by the addition of a few drops of any mild alkaline solution, by which it will be readily disengaged. Again; if sulphur be present, it will be precipitated along with the alumina, and increase its weight. This test, however, of the strength of alkalies can never be a standard of much accuracy, unless the acid employed be always of the same strength. This may be done, with sufficient exactness for ordinary purposes, by diluting the acid to the same degree by the hydrometer. Let the test, for instance, consist of one part of acid and five of water. When the mixture has cooled down to the temperature of 60°, observe the height to which the hydrometer rises, and make this the standard for subsequent trials.

M. Descroizilles has given a long account of an alkali meter, invented by him, in the sixtieth tome of the Annales de Chemie, but I do not know whether it has ever been brought into use; a description of it may be also seen in the Philosophical Magazine for 1807.

There has been another method proposed for discovering the purity of the vegetable alkali: put a given quantity of potash into twice its weight of water; stir the mixture during the solution of the salt, and

filter it while warm, through blotting paper, adding gradually, after all the liquor has passed through, a small quantity of cold water to wash out the remaining alkali. What remains on the filter, is sulphate of potash, which, after being dried, must be accurately weighed. The clear solution which has passed through the filter is evaporated in a sand bath, till it is reduced one-third, and set in a cool place for 24 hours; when, if the crude alkali contained muriate of soda, it will be found crystallized at the bottom of the vessel in a regular cubical form, which also is to be dried and weighed. The weight of this, together with that of the sulphate of potash formerly obtained, being deducted from the weight of the crude material, will give the precise weight of the pure alkali which it contains. Pearl ash, being milder than potash, is commonly preferred for any of the nicer processes in bleaching. The pearl ash is prepared by a longer continued calcination of the materials of potash at a low heat, by which the combined sulphur and carbon, are expelled or decomposed. The pearl ash of Russia and America, however, contains a large proportion of neutral salts, of which the bleacher must endeavour to deprive it. Several extensive works have lately been established for the purpose of preparing this for the use of bleachers and others; and the article can be afforded as cheap as the foreign, and much purer.

FOR THE FRANKLIN JOURNAL.

MECHANICAL JURISPRUDENCE.—NO. XV.

BY PETER A. BROWNE, Esq.

On the Law of Patents for New and useful Inventions.

OF THE SPECIFICATON, OR DESCRIPTION.—*Continued.*

With regard to the *language* to be used by patentees in the specification, there are several rules to be observed.

In the first place, the statute does not require the use of any *technical terms.* Lord Kenyon, C. J. in the case of Hornblower v. Boulton, says, "no technical words are necessary to explain the subject of a patent; as lord Hardwicke said upon another occasion, 'there is no magic in words.'"

But the party must set forth his invention intelligibly, in the most clear and unequivocal terms of which the subject is capable.

For this we have the authority of Mr. Justice Rooke in Boulton v. Bull, and Mr. Justice Ashhurst in Turner v. Winter. 1 Term Reports, 602. The latter proves that "it is incumbent on the patentee to give a specification of the invention in the *clearest* and *most unequivocal* terms of which the subject is capable."

There must be nothing put into the specification merely to puzzle. The King v. Arkwright was a *scire facias* to repeal a patent for an invention for certain instruments or machines for preparing silk, cotton, flax, and wool, for spinning. The machines were ten in number. Two of them, Nos. 8 and 9, were of no use; it was contended that

there were two distinct machines; one composed of Nos. 3, 4, and 5, and the other of 6, 7, and 10; that they acted differently; what was proper for the hemp, not being proper for the wool: but this distinction was not stated in the specification. Buller, Justice, on this part of the case, remarked as follows: "What is there *in the specification* that can lead you to say you must make use of *three* things for *one* of the machines, and *three* for the *other*, and which three for one or the other? And even were it so; what is to become of the other four? If those are of no use but *to be thrown in merely to puzzle*, I have no difficulty to say, upon *that ground alone* the patent is void, &c."

The specification is not directed to the ignorant, but to men of the profession to which the invention belongs, or is most nearly allied, and the language should be such as will be understood by men of tolerable skill.

In the case of Arkwright v. Nightingale, lord Longhborough says, "The clearness of the specification must be according to the subject matter of it: it is addressed to persons in the profession, having skill in the subject, not to men of ignorance; and if it is understood by those whose business leads them to be conversant in such subjects, it is intelligible."

This is what is meant by that part of the 3d section of the act of congress, which says, "to enable any person *skilled in the art or science*, of which it is a branch, or with which it is most nearly connected, to make, compound, and use the same."

Lord C. J. Gibbs, in the case of Manton v. Manton, Davis on Patents, 333, says that the explanation should be made so that persons of *tolerable* skill may make the thing by means of the specification.

A specification is not good that requires a man of ingenuity to supply its defects.

In the case of the King v. Arkwright before cited, Buller, Justice, says, "It has been truly said by the counsel, that if the specification be such, that *mechanical men of common understanding*, can comprehend it, to make a machine by it, it is sufficient; but then it must be such, that mechanics may be able to make the machine by *following the direction of the specification*, without any new inventions or additions of their own."

A specification is not good if it requires expense and experiments to aid it.

This was ruled by Buller, Justice, in Boulton v. Bull, where he says, "If the negative appeared, namely, that a mechanic could not, from the specification, make an engine with equal effect, or *if it required expense and experiments* before it could be done, I agree that either of those facts would avoid the patent."

A mere redundancy will not vitiate a specification.

This may be collected from what is said by Eyre, C. J., in Boulton v. Bull, 2 Henry Blackstone's Reports, 463. "That if there was a specification to be found in that paper, that went to the subject of the invention as described in the patent, he thought the rest might very well be *rejected as superfluous*."

The Act of Congress requires that the invention shall be so described "as to distinguish the same from all other things before known."

It would seem however to be sufficient, if what is claimed as new appears with *reasonable* certainty on the face of the patent; either expressly or by necessary implication; but it must not be left to minute references and conjectures, from what is previously known or unknown; since the question is not what was before known, but what the patentee *claims as new*. This is the language of Judge Story, in Lovell v. Lewis, 1 Mason's Reports, 188, 189. And whether the invention itself be thus specifically described with *reasonable certainty*, is a question of *law* upon the construction of the terms of the patent, of which the specification is a part. For this rule also we have the authority of Judge Story in the case of Lovell v. Lewis.

It has been decided in England that the articles of the specification which denote *intention only*, and do not state the thing to which it is to be applied, will not maintain an action. For which see the opinion of Mr. Justice Rooke, in Boulton v. Bull. "As to the articles of the specification which denote intention only, and do not state the thing to which it is to be applied, I do not think he could maintain an action for a breach of these articles; for he cannot anticipate the protection before he is entitled to it by practical accomplishment."

How far this would be considered as the law of the United States must depend upon the wording of the act of congress; the 3d section requires the patentee to explain the several modes in which he has *contemplated* the application of that principle or character, by which it may be distinguished from other inventions, &c.

I have not observed any decision in this country on this point.

THE DRAWINGS.

The next thing required by the Act of Congress is that the whole shall be accompanied with drawings and written references, where the nature of the case admits of drawings. The 3d section of the act of 1793 says, "and he shall accompany the whole with drawings and written references, where the nature of the case admits of drawings."

In England no drawing is necessary if the specification is intelligible without it.

In the case of Boulton v. Bull, 2 Henry Blackstone's Reports, it was objected that there was no drawing or model, and Mr. Justice Rooke, in delivering his opinion, says—"The objection is that there is no drawing or model of a particular engine; and where is the necessity for such drawing or model, if the specification is intelligible without it?"

It was before stated that even the specification or description is not expressly required by the statute of James, but that a clause or proviso is generally inserted in the British patents, that, if the patentee shall not, within a stated time, particularly describe and as-

certain the nature of said invention, and in what manner the same is to be performed, by *an instrument of writing* under his hand and seal, and cause the same to be enrolled in the Court of Chancery, then they shall become void. See Harmar v. Payne, 11 East's Reports, 101. Godson on Patents, Appendix, 374. It must be observed that the words are "*by an instrument of writing*."

But a drawing being an easy way of illustrating the different parts of a machine, it has been the practice to annex them to the specifications made in England, under the above proviso: and they have been mentioned in several decisions which we shall briefly notice.

It was formerly decided that the drawing did not constitute a *principal* or *essential* part of the specification; but that the specification ought to contain within itself all the necessary information, without having recourse to the drawing.* But it has been since ruled, that, if a drawing, or figure, enable a workman of ordinary skill to construct the improvement, it is as good as any written description.

As the Act of Congress makes the drawing a part of the specification, it may be presumed that if the written description and the drawing *together* will enable a mechanic of tolerable skill to construct the machine, it is all that is required. It was also formerly held that when a drawing was introduced, it was indispensable that it should be drawn to a *scale*. See 11 East's Reports, 112, 14, Vez.'s Reports, 130. But this rule has been relaxed, and if a mechanic of ordinary skill can make the machine from the drawing *in perspective*, no scale is necessary. See Godson on Patents, 119.

I am not aware of any American decision which requires the drawing to be executed to a *scale*.

The Act of Congress expressly requires that there shall be written references accompanying the drawing.

SPECIMENS OF INGREDIENTS.

When the invention is of a *composition of matter*, the Act of Congress requires the applicant to deposit in the secretary of state's office, specimens of the ingredients, and of the composition of matter, sufficient in quantity for the purpose of experiment. The words are these—"or with specimens of the ingredients, and of the composition of matter, sufficient in quantity for the purpose of experiment, where the invention is of a composition of matter." 3d section of the act of 1793.

None are required by the English law or practice.

It is a subject of curious remark, that although the Act of Congress, by requiring a sufficient quantity of the ingredients to experiment, seems to contemplate their trial in that way, yet there is no authority in the law for any one to use them in that manner.

* See 37 V. Rep. Arts, N. S. 105 and S. C. 4 Barn. and Ald. Rep. 541. 1 Stark, N. P. C. 201.

OF THE MODEL.

By the Act of Congress the applicant must deliver a MODEL of his machine, *provided the secretary shall deem such model to be necessary.*

The words are—"and such inventor shall, moreover, deliver a *model* of his *machine*, provided the secretary shall deem such model to be necessary." 3d section of the act of 1793.

The things mentioned in the first section as objects of the patent law, are "any new and useful art, machine, manufacture or composition of matter." The part of the act which speaks of the model, uses the word *machine* ONLY.

The act also leaves it in the discretion of the Secretary of State to require the model or not.

In point of practice (as I have understood) they are seldom required.

No model is required under the British statute, or proviso, or practice.

APPLICATION FOR A PATENT IN ENGLAND.

In England the following is the routine to obtain a patent, where there is no opposition.

1. The petition and affidavit (the latter having been sworn to, before a master in chancery) must be left at the office of the Secretary of State for the home department, who refers it to the Attorney and Solicitor General.—2 Thence it is taken to the Attorney and Solicitor General for their opinion, or report.—3. It is taken to the office of the Secretary of State, for the King's warrant.—4. This warrant is carried to the patent office of the Attorney or Solicitor General, who draws a bill.—5. The bill is carried to the office of the Secretary of State, for the King's signature.—6. It is then taken to the signet office, for a warrant to the Lord Keeper of the privy seal.—7. At the office of the Lord Keeper, another warrant is obtained, directed to the Lord Chancellor.—8. Next it is taken to the patent office of the Lord Chancellor, where the patent is made out and sealed.—9. The specification must be acknowledged before a master in chancery, and then must be taken to the Enrolment Office to be recorded.

APPLICATION FOR A PATENT IN THE UNITED STATES.

1. The applicant pays thirty dollars into the treasury, for which he receives duplicate receipts.—2. The petition, affidavit, specification, drawings, &c. together with one of the above receipts, are taken to the patent office, (which is a branch of the office of the Secretary of State) where the patent is made out.—3. The patent is taken to the Attorney General of the United States for his examination and approbation.—4. When the Attorney General has given it his sanction, it is returned to the patent office, where it is signed and sealed, and delivered to the applicant.

Inventors should be very careful in the preparation of their papers, when about to apply for a patent; a very slight inadvertent omission may deprive them of the fruits of all their labour. They should not depend too much upon their own skill or experience; Mr. Godson very justly remarks, that "a man whose thoughts have dwelt long on the same subject, overlooks many things forming part of a manufacture, which led him to the invention." Prudence will dictate, to call in the aid of others, and it will be obvious, that in making that selection, it will be well to inquire which of his friends possesses, in the highest degree, the combined knowledge of *law* and *mechanics*.

INTERFERING APPLICATIONS.

The next topic of consideration is the proceedings that are to be had upon interfering applications for a patent.

The 9th section of the Act of Congress, provides, "That in case of interfering applications, the same shall be submitted to the arbitration of three persons, one of whom shall be chosen by each of the applicants, and the third person shall be appointed by the Secretary of State; and the decision or award of such arbitrators, delivered to the Secretary of State, in writing, subscribed by them, or any two of them, shall be *final, as far as respects the granting of the patent:* and if either of the applicants shall refuse, or fail to choose an arbitrator, the patent shall issue to the opposite party. And where there shall be more than two interfering applications, and the parties applying shall not all unite in appointing three arbitrators, it shall be in the power of the Secretary of State to appoint three arbitrators for the purpose."

The sole object of this arbitration is to ascertain which of the conflicting applicants is *prima facie* entitled to the patent, and the patent, when obtained, is liable to be repealed or destroyed by precisely the same process as if it had issued *without* objection, or arbitration.

This is the language of Judge Story in the case of Steans v. Barret, 1 Mason's Reports, 174.

A refusal to submit to the arbitration, is not *per se* conclusive evidence that a patent, afterwards obtained, was obtained surreptitiously.

This also was decided in the last cited case. The plaintiff and defendant had conflicting claims for a patent, the plaintiff offered to submit to the award of arbitrators, to be chosen according to the Act of Congress, but the defendant declined, and afterwards took out his patent. Upon an application to the District Court to set aside the patent, it was contended that this refusal to arbitrate, and afterwards taking out his patent, were *conclusive evidence* that his patent was surreptitiously obtained. The Court charged the Jury, that these circumstances, alone, did not support the suggestion. Afterwards, upon a motion for a new trial, this opinion was reviewed; when Story, Judge, expressed himself in the following manner. "The first objection taken to the opinion of the Court below is, in substance, that

the Court ought to have directed the Jury, that the refusal of the defendant to submit the claim to arbitration, under the circumstances detailed in the evidence, (which brought it within the 9th section of the patent act) and subsequently obtaining a patent after the plaintiff had obtained his, was *conclusive* evidence that the patent of the defendant was obtained surreptitiously, or upon false suggestion; whereas the court held, that these facts were not *per se conclusive* to establish this point. In my judgment, there was no error in this opinion of the Court. If an arbitration had been actually perfected between the parties under the 9th section, the award or decision of the arbitrators would have been final between the parties, only so far as respected the granting of the patent, it would not have concluded the parties from showing in the present suit, that it was obtained upon false suggestions, it would not have concluded them in an action for an infringement of the patent, from asserting any defence allowed by the 6th section of the patent act. The sole object of such an award, is to ascertain who is, *prima facie*, entitled to the patent; but when once obtained, the patent is liable to be repealed, or destroyed, by precisely the same process, as if it had been issued without objection. If the award itself would not have been conclusive, *à fortiori*, a refusal to join in an arbitration under the statute cannot be so."

In England, the practice is somewhat different, with respect to interfering claims for a patent, for the same invention. The opposing party enters a *caveat* at the office of the Attorney and Solicitor General, and upon notice given an examination takes plaee, and a separate audience is given by one of these officers to each party, after which, report is made to the king. If the party entering the *caveat* is not satisfied with the decision of the Attorney or Solicitor General, an audience may be had before the Lord Chancellor, who examines and decides upon the pretensions of the parties. If the applicant thinks he is unjustly deprived of a patent for his invention, he may, after being heard by the Lord Chancellor, take a *scire facias* to repeal the patent that has been sealed.

OF THE REFERENCE TO THE ATTORNEY GENERAL.

The 1st section of the Act of Congress requires, that the letters, before they pass the signature of the President, and the seal of the United States, shall be delivered to the Attorney General of the United States, *to be examined;* who, within fifteen days after such delivery, *if he finds the same conformable to the Act*, shall certify accordingly, at the foot thereof, &c.

Judge Story is of opinion that it was probably with a view to guard the public against the injury arising from defective specifications, that the statute requires this examination by the Attorney General; but he admits, that, in point of practice, this must unavoidably be a very insufficient security. See Whittemore v. Cutter, 1 Gallison's Reports, 429. It does not seem that the Act of Congress intended to invest the Attorney with any *judicial* power.

In like manner, in England, the Secretary of State for the

home department, refers a petition for a patent, to the Attorney or Solicitor General, who gives a certificate that inasmuch as it is at the hazard of the petitioner, whether the invention be new, or will have the desired success, and as it is reasonable that his Majesty should encourage arts and inventions, it is therefore, his opinion, that the letters patent should be granted, provided the proviso before mentioned be enrolled in the Court of Chancery, &c.

ENGLISH PATENTS.

Patent granted to James Ogston *and* Thomas Bell *of London, watch makers, for improvements in the manufacture of watches of different descriptions. Communicated by a foreigner.* Dated Jan. 6, 1826.

The object of this method of constructing watches, is to make them considerably thinner than those in common use, without diminishing the force of the impelling power.

The great obstacle to the reduction of the thickness of watches, lay in the main spring; as it is evident, that, if its breadth were reduced, one half for example, in order to make the watch thinner, its power must also be one half less than it was originally. This difficulty is surmounted in the watches for which this patent is granted, by using two main springs in them, each of half the breadth required for the force necessary for the motion, instead of one of the usual breadth.

On the external cylinders of the boxes of these main springs, toothed rings are formed, each containing seventy-five teeth, which work into a deep leaved pinion in the centre of the watch, that is fixed on the same axle with the large wheel which gives motion to the rest of the train. That the two main springs may lie closer to each other, the toothed rings are formed at different elevations on their respective cylindrical cases, and each of them has a ratchet wheel, about the same diameter as its box, attached to its axle, and furnished with a spring click, or catch; and the two are turned round together to wind up the springs, by means of a third ratchet wheel, the teeth of which interlock with the other two, which third ratchet wheel has a square head on its axle, for the reception of the watch key. The patentees state that this square head is contrived so as to admit the key to go deeper on it than what is usual, by which it will be less liable to be broken; but their manner of explaining how this is effected, not being very clear, we are not quite sure that we are accurate in supposing it to be done by surrounding the square head with a small hollow cylinder, attached to the ratchet wheel itself, and working in the frame plate in the manner of a pivot. The same effect might also be produced, by making the end of the key a solid square prism, and forming a corresponding cavity for it, in the axle of the ratchet wheel itself, sufficiently large for this purpose.

Watches of this kind, as may already appear from what has been mentioned, have no fusee wheels, or chains; and in order to supply their effect, the main springs are made tapering from the axle to the outer coil; which, the patentees assert, will effectually equalize the motion. Horizontal, or duplex escapements are advised to be used with them; but their other parts do not so materially differ from those in ordinary use, as to require a particular description for our general readers, although those who intend to make watches of this kind, may find the more particular information respecting them worth notice, which the specification details with great minuteness.

We have now only to add, that the patentees advise these watches to be jewelled in the usual parts, and to mention, what was before implied, that in them the winding up of the main springs, is effected, by turning round the axles to which they are attached, instead of making their boxes revolve, according to the general practice.

The above seems an ingenious method of effecting the intended design; and we have only to observe, with regard to the tapering main springs, that, in the first place, this manner of forming them is no new invention, having been used for *pendules*, or chamber clocks, for a considerable time in Paris; and, secondly, that we have some doubt of their having the effect asserted, as from the spiral spring acting in all its parts simultaneously in turning round the box, the weakening any one part of it, could, as we conceive, only diminish the general effect, instead of making its energy less at a particular part of the revolution; and we cannot allow the good performance of the watch, to be a decisive proof in support of the contrary opinion, as it has been well known, that the regularity of a watch depends almost entirely on the perfection of the escapement, and very little on that of the other parts. In 1776 M. Peter Leroy made a chronometer, without any fusee and chain, which performed exceedingly well, in which he relied entirely on the excellence of the escapement, and used only a common main spring, of equal breadth and thickness in every part of its extent. We think, however, that the question might be easily determined by experiments of a different description.

[*Repertory of Patent Inventions.*

Patent granted to Hugh Evans, *Harbour-Master of the Port of Holyhead, North Wales, for a method, or methods, of rendering ships and other vessels, whether sailing or impelled by steam, more safe in cases of danger by leaking, bilging, or letting in water, than as at present constructed.* Dated Feb. 7, 1826.

The chief object of the above patent, is to make the lower deck of the ship, or orlop-deck, impervious to water from beneath, and so securing it in other respects, as to enable it to serve as a second bottom in supporting the vessel, in case of the primary, or external bottom being damaged so as to occasion dangerous leaks. This lower

deck is made to have the properties mentioned, by having additiona beams put in, with knees both above and below them, and strong stancheons to support them, and by being ceiled, or planked underneath; which ceiling, as well as the ceiling or internal planking of the sides, is to be well calked, so as to be water tight; and the spaces between the timbers or ribs of the vessel, where they come in contact with the lower deck, are to be also filled up and calked for greater security; moreover, to produce greater strength in this lower deck, it may be made convex, or rounded like the external bottom, "with a curvature of one inch in every four feet." Passages, or hatchways, are also to be made through this lower deck, under the hatchways of the other decks, and to be secured by well calked shutters underneath, in addition to those above them.

Besides being defended by this lower deck, or second bottom, the ship is also to be farther secured by strong water-tight bulkheads, or transverse partitions; of which two at least should be made in every vessel, but more may be added, according to the nature of the cargo, or the purpose for which it is intended. These partitions are to be constructed of strong uprights passing from the floor timbers to the beams, as close together as is necessary to resist the pressure of water, secured by chocks both above and below, into which they are to be dovetailed, and are to be planked and calked at both sides; and where the partitions join the sides of the vessel, battons are to be fastened at the angles, to make the whole more stanch and secure.

In ships of war, and large vessels, the patentee farther recommends another partition to be constructed, the whole length of the ship, fore-and-aft, directly over the kelson, which is to be planked and secured, in all respects like those already described.

The hold will be divided into several compartments by the transverse partitions, from each of which two pipes are to go to the pump well, one at each side of the kelson, which pipes, as well as the apertures made through the limber boards for the water, are to be furnished with "sluices," or paddles, with rods passing up from them to the upper deck, by which they may be raised or lowered; which arrangement will permit the water from any one of the compartments to be pumped out, independent of the rest.

Steam boats, as well as other vessels of a smaller size, are to have two transverse water-tight partitions, in addition to the lower, or second bottom, secured as before mentioned; and in them these partitions are to be covered at the side next the steam engine with fire tiles, as the sides of the vessels should also be within the same compartment, to stop the progress of accidental fires; which in vessels thus constructed can be speedily extinguished, by having cocks or valves opening from without, made so as to admit the water in sufficient quantity into the steam engine chamber; from whence the water-tight partitions, and the well calked internal planking of the vessel, will prevent its passing into the other compartments of the vessel, so as to preclude all danger of its being sunk by their being filled.

The safety of seamen demands every encouragement to be given to effectual plans for making vessels secure from foundering through the effect of leaks; an accident that we believe happens much oftener than is suspected. Security to the cargo is also a very material consideration, since an insurance can at most only repay the first cost, but cannot extend to the time lost by the failure of the venture, and the consequent loss of profit, or interest of money; and security against fire is also of the utmost importance, as it is perhaps the most appalling calamity that can happen at sea.

We doubt, however, the novelty of the principal part of the plan of the patentee, consisting of the water tight deck, which serves as a second bottom to the ship; as decks, or internal bottoms of this sort, were constructed many years ago by Mr. Barnard, in several vessels; of which an account may be seen in the second volume, p. 185, of the Transactions of the Society for the Encouragement of Arts, &c.

The curved form for these decks may, however, be new; but both they when thus made, and the water-tight transverse partitions, would be much objected to by seamen, from the interruptions which they would cause to stowage; and moreover transverse partitions of this sort have been used from time immemorial by the Chinese, in their large junks, or merchant vessels. [*Ib.*

To William Duesbury, *of Bosel, in the County of Derby, Colour Manufacturer, for his having discovered a mode of Preparing or Manufacturing of a white from the impure native Sulphate of Barytes.* Dated September, 1823.

The object of this invention, appears to be the production of a material intended to be employed as a substitute for white lead in painting, which material, when prepared according to the process of the patentee, is found not to be susceptible of decomposition, or of changing its hue in situations which are exposed to damp or sulphurous effluvia. It is, however, more particularly designed for water colour than for oil, and when employed on flatted or distempered walls, and as the ground washes, or in the patterns of printed paper hangings, it is found to be a *constant white*, that is, to retain its snowy hue unimpaired and unaffected by any chemical action, to which a humid atmosphere might expose it.

The patentee takes the impure native sulphate of barytes, or what is commonly known by the names of cawk, heavy spar, ponderous earth, terra ponderosa, vitriolata, marmor metalicum, &c. which materials are to be found in several parts of this country in large quantities.

These are to be picked, and washed as clean as may be from impurities, and then ground or otherwise reduced to minute particles in a pan or colour-mill, or other proper apparatus, with the addition of

water. The cawk, so ground, is then to be transferred into a leaden cistern or boiler, and more water added to it.

The cistern or boiler should be supported upon iron plates, having a proper fire-place and flues underneath, constructed in brick-work as usual, in order that the contents may be brought to a boiling heat. To the cawk thus boiled, a quantity of sulphuric acid is to be added, the proportion of which to the cawk, must depend upon the quantity of iron supposed to be contained in it; but this, however, may be ascertained, by taking portions of the cawk out from time to time during the boiling, and examining it, in order to discover whether it has attained the proper degree of whiteness; and if not, more acid must be added, and the boiling be continued, until the desired colour be produced, the materials being frequently stirred during the process, to prevent their adhering to the bottom of the boiler. The prepared cawk must now be repeatedly washed with water, until the solution of iron is removed from it, and then dried in a stove, or by any other convenient process, to fit it for use. Under some circumstances the patentee employs other acids instead of the sulphuric, or compounds of acids with such bases as will act upon iron, with the intention of dissolving the iron, but in general he prefers to use the sulphuric acid in the manner above described.

In the event of employing other acids, or such other compounds as would act chemically upon the leaden boiler, vessels of glass or earthenware properly glazed, or of other materials not liable to be attacked or corroded by the said acids, or their compounds, must be used instead of the leaden boiler. It is stated that copper boilers may be employed instead of leaden ones, even when using the sulphuric acid to dissolve the iron, but the preference is given to those boilers which are formed of lead.

The patentee says, in conclusion, "I do not mean or intend hereby to claim, as my invention, the apparatus herein described, but solely to limit my claim to the purification of the impure native sulphate of barytes, or by what other name it may be called, from its colouring matters, by the action of acids or their compounds, and rendering the same equally fit for those purposes to which white sulphate of barytes is usually or may be applied in the arts."

[*London Journal of Arts and Sciences.*

To WILLIAM HENRY JAMES, *of Coburg Place, Winson Green, near Birmingham, in the County of Warwick, Engineer, for his Invention of certain Improvements in the construction of Steam Boilers for Steam Engines.* Dated December, 1825.

THERE are two principal objects proposed by the patentee in this invention, the first of which, is to expose a very extended surface of boiler to the action of the fire, in order that a great quantity of steam may be rapidly generated in a comparatively small vessel; and secondly, to prevent the dangerous consequences that frequently attend

explosions in the event of any part of the boiler becoming fractured; which is to be effected by constructing the boiler of many distinct chambers or vessels, combined together, in order that any fracture in one part of the boiler, (that is one of the distinct vessels) may not communicate to the other parts of the boiler, so as to rend the whole, and by which contrivance only a small portion of steam and water, could be discharged, in case any such accidental explosion should take place.

This boiler appears to be designed principally for a locomotive engine, or steam carriage, and is intended to be combined with other improvements relative to those machines, for which the same inventor has previously obtained patents (see our IXth and Xth volumes.) It is expected from very satisfactory experiments which have been recently made by the patentee, that he will shortly exhibit his invention in operation, we shall then take the earliest opportunity of communicating the results to our readers, and also our own opinions as to its novelty and practical usefulness.

The patentee states, that this improvement in the construction of boilers for steam engines, consists, "first, in forming the said boilers by combining a series of annular tubes, or a series of ring-formed chambers; which chambers communicate with each other by apertures running through the whole series, in order to allow the water and the steam to flow freely from end to end of the cylindrical vessel so formed by the combined tubes or chambers; and which vessel, has a furnace adapted, within it, for the purpose of heating the water, and the steam contained in the annular tubes or chamber. Secondly, in a contrivance by which the boiler may be made to revolve, or to oscillate for the purpose of cleansing its interior from sediment or incrustation, caused by the boiling of the water.

Through the series of annular tubes or chambers, apertures are to be made lengthwise along the top and bottom, for the purpose of obtaining free passages by which the water and steam may flow, thereby forming the whole series of annular chambers into one vessel, of capacity, which is to be occupied with water rather more than half way up.

A furnace is to be inserted within the cylinder, supported upon suitable bearings, and capable of sliding in and out, which with its flue occupies the whole interior of the cylinder of rings, and the flame and heated vapour arising from the furnace in passing from thence to the chimney, enters the jacket and embraces the external surface of the combined ring-formed chambers or cylindrical vessel. By these means the water in the lower parts of the vessel is made to boil, and the steam generated therefrom rising into the upper parts of the vessel, becomes greatly increased in its elastic force by the immediate action of the fire, and the jacket is coated with pulverized charcoal, or other imperfect conductor of heat, for the purpose of preventing its radiation.

As it may be found that the water in boiling deposits earthy matter, which adheres as a crust to the interior of the vessel, it is proposed to place at the bottom part of each chamber a few shots, mar-

bles, or other loose articles, in order to clean the interior of the boiler by friction, and to assist this object it is contrived that the boiler shall be capable of revolving, or vibrating. When it is wished to clean the boiler, the furnace must be withdrawn, and the steam and water pipes unscrewed, then (having nearly filled the chamber with water) by manual labour applied to the handles, the boiler must be caused to revolve, or to vibrate to and fro upon its axle, and guide-rollers, when by the friction of the shots above described, the incrustation or sediment, will be broken up and discharged, with the water employed in washing it.

It has been found desirable to adapt a revolving cock, to give such supplies of water to the boiler, through the supply-pipe, as may be found necessary. This is proposed to be actuated by a movement from the engine as is usually done. By this particular construction of cock, when even the water in the boiler is above the desired level, it flows up to the aperture of the cock, and prevents a further supply from passing; but when the water in the boiler is below its desired level, then a supply is delivered every time that the cock revolves. The steam rising into the upper parts of the chamber of the boiler, escapes through the bent tube, and proceeds by the pipe to the engine.

The patentee says, in conclusion, "I wish it to be understood that I do not limit my claim of invention to the precise forms exhibited in the figures of the parts of which this my improved boiler is constructed, as the tubes or chambers may be eliptical, or of other forms slightly deviating from a circle. Neither do I mean to limit myself to such tubes as are square in their sectional figure, as round or other formed tubes united together would answer the purpose. And although I prefer the construction and forms exhibited in the figures, yet I should consider the above variation to be imitations of my invention, in case a boiler for a steam engine was constructed, by combining a series of annular tubes or ring-formed chambers, with passages extending through the whole series, for the purpose of allowing the steam and water to pass freely from one to the other. And lastly, I claim the manner of mounting such boiler, to be turned round or made to vibrate, in order to clean their internal surfaces from sediment or incrustation.

To WILLIAM MAYHEW, *of Union Street, Southwark, in the County of Surrey, and* WILLIAM WHITE, *of Cheapside, in the City of London, Hat Manufacturers, for their new invented Improvement in the Manufacture of Hats.* Dated August, 1826.

THE patentees observe that there are two objections to what are called silk hats as usually made, viz. that the hardness of the body, or shell of the hat, over which the silk covering is laid, frequently hurts the head of the wearer; and the edge of the crown being much

exposed to blows, the silk nap soon becomes worn off, and exposes the cotton foundation of the covering, which being a vegetable material, is not capable of receiving so good a dye as the silk, and the hat immediately looks shabby. To remedy these defects, therefore, is the object of the present patent.

The hat body is to be made of stuff or wool as usual, and the unyielding stiffness of the inner part round the brim, is proposed to be relieved by attaching a coating of beaver or fur, on the under side of the brim, which will render the hat soft and pliable. Round the edge of the tip or crown, a quantity of what is called stop wool is to be attached, by the ordinary operation of bowing, which will render the edge soft and elastic. The hat is afterwards to be dyed of a good black colour, both inside and outside. And then being properly stiffened and blocked, is ready for the covering of silk.

The plush employed for the covering of hats is a raised pile or nap of silk woven upon a cotton foundation; and the cotton being incapable of receiving so good a dye as the silk, presents a disagreeable brown appearance when the silk nap is worn off. The patentees therefore propose to make the foundation of the plush, which shall be employed for covering the tip or top of the crown, entirely of silk as well as the pile: and by that means cause the edges of the hat to preserve their colour, in the event of the nap being injured by blows, or worn off: which indeed is not very likely to take place in these improved hats, the edge of the crown being padded as above described, with a soft elastic material. [*Ib.*

A new method of bleaching and preparing Flax. By the Rev. J. B. Emmett.

On account of the great distress which prevails in most of the manufacturing districts, I have been induced to present to the public the following means of bleaching and preparing flax and tow, by a simple, easy and cheap process, whereby it is reduced to a beautiful degree of whiteness, becomes possessed of a silky lustre, and is made sufficiently fine to be manufactured into the finest goods; hoping that it may become the means, in the hands of opulent manufacturers, of giving employment to some of the workmen, who are unable to meet with it.

The process is as follows: Steep or boil the flax or tow in a weak solution of subcarbonate of potash or soda, in order to extract the colouring matter, resin, &c. I prefer the subcarbonate to the pure or caustic alkali, because, however diluted the latter may be, its powers of corrosion are so great that if it extracts the extraneous matter perfectly, it will almost certainly diminish the strength of the fibre; whilst I find that it may be thoroughly extracted by the former, without producing any such effect: this I have proved by experiments made upon rather large quantities. Wash it thoroughly from the alkali.

The bleaching liquor is prepared in the following manner: Reduce perfectly fresh burnt charcoal of soft porous wood, as willow, or fir, to a very fine powder; tie up the powder in a bag made of cloth of a close texture; immerse it into cold soft-water, and work it by pressing it with the hands, until such a quantity shall be diffused through the water, that on rinsing a little flax through it for a few minutes, and then withdrawing it, it shall be lightly blackened. Put into it the flax to be bleached, taking care that each parcel shall imbibe it to its middle. When all is put into the liquid, the water, on being well agitated, ought to be clouded by the charcoal. I cannot specify the exact proportion, as I observed it no further than this,—that I always used more than was actually requisite: in bleaching 6 or 7 pounds, I never used more than half an ounce. Agitate the liquid, and press the flax under it several times in the day, in order to bring as much charcoal as possible into contact with it. After about twenty or twenty-four hours, remove it from the liquid, having it well rung, put it into a second, which may contain less charcoal: agitate as before, and after the same interval of time, examine a small parcel by washing it with soap and hot water: if the colour be good, remove it from the charcoal-liquid; if not, allow it to remain another day, or until it becomes white: two or three days are amply sufficient if the process be well conducted. It is advantageous to spread it out thinly upon the grass, wet as it is, and having the charcoal in it, taking care to turn it frequently for a few days: the charcoal gradually disappears, and the surface acquires a pearly appearance.

The flax is now to be rinsed in a large quantity of water: then to be washed thoroughly with soap in hot water, till it is quite clean; the soap must then be washed out by cold water, and the flax dried; if on the grass, exposed to the sun and air, the better.

Before washing out the charcoal with soap, the lustre of the fibre will be improved by steeping it for eight or ten hours in water just soured with sulphuric acid; if this process be continued too long, the fibre will be weakened. The acid-steeping is not essential, except the flax be intended for some particular uses.

The charcoal is easily washed out, and that perfectly, with soap. The ultimate fibres are perfectly separated: they are so much finer than silk, that I use them in the quadrant, transit, and micrometers: the lustre is precisely that of silk; the strength of the fibre is not at all impaired. It takes such colours as I have tried—blue, pink and yellow—perfectly. The finest thread may be spun.

Having made public the process, and particularly on account of my reason for so doing, I hope that manufacturers and others who can forward the introduction of the material, will bestow some attention upon the subject.

P. S. It may probably be worthy the attention of the Irish; and particularly since the process may be performed by individuals at their own houses, and may give employment to many paupers in the work-houses.

[*Annals of Philos.*

On an improved mode of etching Steel Plates.

By Mr. W. Cooke, *Jun., Engraver.*

From the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

Dec. 21, 1825.

Sir—As the Society of Arts have given a portion of their attention to the subject of engraving on steel plates, and as many experiments have failed, I feel great pleasure in making the following communication public through the medium of the society.

For the best mode of biting-in hitherto published, we are indebted to the great perseverance of Mr. Turrell; but the difficulty and danger of using his menstruum on a soft ground, or when the varnish is not sufficiently dry, induced me to use the acids in different proportions, and to leave out the alcohol, as the composition was found to act on the ground, causing the whole surface of the plate to be corroded; this has frequently happened.

It is necessary to mention, that all plates for landscape engraving should be made of steel not completely decarbonized.

I beg to submit a few preparatory directions previous to etching.

The steel should be carefully cleansed (before laying the ground) with turpentine only, omitting the whiting which is used in preparing the surface of copper.

The ground should be laid with as little heat as possible, steel needing not so much as copper; too high a temperature decomposes the ground, and occasions it to produce small air bubbles, or to evaporate in a light smoke from the surface of the plate; should this take place, the ground must be re-laid. It is also highly necessary that in etching the point should penetrate the surface of the steel, and the breath not be suffered to condense on the etching, as it will cause the lines to rust, and will prevent the acid from biting well. The plate being ready for biting-in, the process is as follows: mix, by gentle shaking, six parts of acetic acid, and one part of nitric acid.

This mixture, being very rapid in its action, should be taken off the plate at half a minute, and the acid well washed out of the lines with water, drying the plate well, but without the assistance of heat. Stop out the light tints with Brunswick black varnish; and then, for the purpose of washing the oxyd out of the lines, pour on the plate a mixture of six parts of water, and one of nitrous acid, letting it remain two or three seconds; take this off, and immediately repeat the former mixture without washing the plate between, with water. This process should be repeated for each tint.

The biting-in of a steel plate should be accomplished, if possible, in one day: this observation holds good in regard to other methods of biting, as the lines will sometimes attract oxygen from the atmosphere during the night, which will prevent their biting with the same degree of clearness as the day before.

When the biting is completed, and the ground taken off, with a strong tooth-brush and turpentine, clean out the remaining oxyd from

the lines, using the fingers for the light tints; then rub the surface of the plate, to remove the bur, with the finest emery paper previously well used on the back of a steel plate to take off its roughness; the more this paper is used the more valuable it becomes for taking out the marks of the scraper from dry point tints.

Re-biting is performed by dipping a clean rag in a very dilute nitric acid, and rubbing it over those parts intended to be re-bitten until the surface becomes dull; clean the plate out as before-mentioned, and in laying the ground the dabber should be used but little, as it is likely to take up the ground again; re-bite with a few drops of nitrous acid in four ounces of water, sufficient to make the water taste sharply of the acid.

The whole process for biting, or re-biting, should be performed in a temperature of about sixty degrees, or higher, and certainly not much below that point.

As the time required to bite-in is the principal thing to be observed, all the light tints should be tried every minute after the first biting; but the deeper ones will require a longer time. A little practice will show these remarks (apparently trifling) to be important.

Biting on very soft steel plates may be accomplished by using the following mixture:—three ounces of warm water, four grains of tartaric acid, four drops of nitric or sulphuric acid, one drachm of corrosive sublimate.

I also submit to the society a new method of graduating skies and other tints.

Incline the plate, by tilting it with two wedges, and pour the re-biting acid into a glass funnel, with a stick inserted in the tube, and kept steady by a twisted copper wire loop; drop the acid on the dark part, and according to the colour of the tint the acid should be made to drop faster or slower, which is regulated by the raising and lowering the stick in the centre, and gives to the acid a tremulous motion, until it is floated over the whole sky; this obviates the old method of sweeping or feathering, which, from the quick action of the acid, occasions streaks to appear in the tints when the ground is taken off.

It is important that engravers should make use of the best acids, and perfectly free from adulteration. From the cheapness of sulphuric acid it is sometimes used with muriatic, to adulterate the nitric acid. The following tests will discover them:—dissolve a little nitrate of barytes in distilled water, and add it to a small quantity of the nitric acid in a phial or test tube; if a white precipitate is discovered at the bottom, sulphuric acid is present; and muriatic acid will form, with a solution of nitrate of silver, a white cloudy precipitate; should either of these effects take place, the acid is not fit for use.

The purest acids are those manufactured by Mr. Remnant, Smithfield-bars, who has made them some years for the use of engravers.

Since writing the foregoing account, I have discovered means of making the ground adhere to the surface of the steel, without using acid to dull the surface.

Dissolve, by gentle heat, (in a Florence flask,) some powdered copal in oil of spike lavender, and evaporate to a thick consistence;

then to one ball of ground, add about one drachm of the copal solution, each having been made warm previous to mixing: lay the ground as before mentioned, avoiding too much heat; the ground may then be laid with the same facility as on copper.

I am, sir, &c. &c.

W. Cooke, Jun.

A. Aikin, *Esq. Secretary, &c.*

The above processes were performed on tinted steel plates, in presence of the committee of polite arts, to their entire satisfaction, and that of several engravers, who were specially invited to witness them.

On a Menstruum for Etching Plates of Soft Steel.

By Mr. W. Humphrys.

From the Transactions of the Society for the encouragement of Arts, Manufactures and Commerce.

April 19, 1826.

Sir—I have a communication to make to the Society for the promotion of Arts, Manufactures, and Commerce, of a menstruum for biting-in steel plates. I have for some time back communicated it to various artists, to get their opinion of its merits, and have the testimony of Messrs. Turrell, W. Finden, &c., that it is the best, cheapest, simplest, and safest in its operation of any acid yet discovered; and those gentlemen will be happy at any time to meet a committee to explain its qualities. In addition, I have specimens of its performance, from several engravers, to lay before the society.

I am, sir, &c. &c.

Wm. Humphrys.

A. Aikin, *Esq. Secretary, &c.*

The composition of the menstruum is as follows:

Take a quarter of an ounce of corrosive sublimate powdered, and a quarter of an ounce of alum powdered, and dissolve them in half a pint of hot water.

Directions.—Let it cool before use. While using it, keep it stirring with a camel's hair brush, and take care to wash the plate perfectly, after each biting. As this acid, though clear before use, becomes turbid during its action on the steel, it may be prudent, in fine works, to throw away each portion of acid after it has been on the plate. The taste and experience of the artist must dictate the length of time he may leave it on his plate; delicate tints are obtained in about three minutes.

It appears from the experience of those artists who have practised engraving on steel, that several of the menstrua employed in the process technically called biting-in, will succeed with hard steel, but give results by no means so satisfactory, when employed on very soft, or nearly decarbonized steel. Nitric acid is the essentially active ingredient in all these menstrua; and the chemist well knows that

when this substance is brought into contact with iron, it usually brings part of it to the state of protoxid, which is soluble in the acid, and also reduces a smaller portion to the state of peroxid, which remains, for the most part, undissolved, adhering to the surface of the iron, and thus preventing that deep, clean, uniform biting which it is the great object of the artist to obtain. The presence of carbon, in a finely divided state, has a tendency to prevent, or at least to retard, the peroxidation of the iron, and this, probably, is the reason why it is less difficult to gain a good result with hard, than with soft, or decarbonized steel.

The composition employed by Mr. Humphrys contained no nitric acid; and, from the testimony before the committee of Mr. W. Finden, Mr. Warren, Mr. Romney, and others, who have tried it, and also from the result of the experiments made in presence of the committee, appears to be superior, for biting-in on soft steel, to any menstruum that has hitherto been used.

On Fustic, (Morus tinctorius) *and its application to the Dying of Yellow, Green, Olive and Brown.* By E. S. George, Esq. F. L. S.

The wood of the Morus tinctorius is employed in dying those shades of yellow, in which intensity of colour is of more importance than brilliancy; and in all the range of colours formed by the mixture of yellow, blue and red.

For those colours in which sulphate of indigo (indigo dissolved in sulphuric acid) is employed to give the blue, it is of great value, resisting the action of free sulphuric acid in a higher degree, than any other yellow colouring matter.

The colouring matter of fustic, is seldom employed in the dying of yellow; the only case in which it is so employed, is as a cheap substitute for weld, or quercitron; but for woollen goods intended to be dyed a true green in the indigo vat, the required shade of yellow is first given by means of fustic.

The dying vessel may be of iron; and for 120 yards of woollen cloth, weighing 1 lb. 4 ounces to the yard, 45 lbs. of fustic in chips, with 6 lbs. of alum, will be found sufficient for ordinary shades of green. If the shade required, be bright, 4 lbs. of solution of tin may be added with advantage; but for bottle green, an additional proportion of fustic will be required: some dyers use the fustic alone, without any mordant, and the affinity of woollen fibre for the colouring matter of fustic, is sufficiently powerful to fix the whole. The addition of a mordant, however, gives much greater durability. After the fustic and alum have been boiled a few minutes, in a dying vessel, containing from 300 to 400 gallons of water, 20 gallons of cold water are added, and the cloths entered, turning quickly a few minutes, and afterwards more slowly, and boiled from fifty minutes to an hour. They are afterwards well washed, and the requisite shade of blue, given in the indigo vat.

Fustic is employed in all the shades known as Saxon green. In this class of colours the blue is obtained from indigo, but by means of its solution in sulphuric acid, known by dyers as *chemic*. The long list of substances employed by the old dyers and chemists, in making this solution, are almost entirely discarded, and sulphuric acid and indigo are the only substances now employed. In making the solution of indigo for greens, an excess of sulphuric acid should be avoided, as it prevents the yellow colouring matter fixing upon the cloth. I have found 9 lbs. of sulphuric acid to 1 lb. of indigo of good quality, the best proportion.

For the dying of 100 lbs. of worsted goods, known as wildbores, a bright green: In a leaden vessel containing 300 gallons of water; when at the temperature of 150° Fahrenheit, I threw in 25 lbs. of alum and 2 quarts of bran, carefully removed the impurities that rose to the surface until the water boiled, then added 2½ pints of sulphate of indigo, 12 lbs. of fustic in chips, and 10 lbs. of white Florence argol (super tartrate of potash,) boiled the whole five minutes, added 20 gallons of cold water, and entered the goods, turning quickly for ten minutes, and then more slowly, at the same time raising the temperature to ebullition. After boiling 45 minutes, found the colour scarcely so full as required, and took out the goods, adding half a pint of sulphate of indigo, and 4 lbs. of fustic, again entered, and boiled half an hour. Fresh goods may be dyed in the same liquid; indeed, in conducting a dying house economically, it is of great consequence so to arrange the colours that they shall follow each other without emptying the dying vessels, as thus a great saving of dying wares is achieved. For 100 lbs. of the same description of goods, and the same shade of colour, added 15 lbs. of alum, 2½ pints of sulphate of indigo, and 7 lbs. of argol; after entering and boiling as before 45 minutes, took out the goods, added half a pint of sulphate of indigo; entered and boiled 20 minutes. It is of importance, that the whole of the indigo should not be given at first, since from the boiling necessary to give evenness to the colour, the lustre is considerably impaired; by adding a part towards the close of the process, both evenness and beauty of colour are ensured. For a third quantity, the same colour, 12 lbs. of alum were added, and the amount of alum in a fourth and fifth quantity, must gradually diminish to 6 lbs. The amount of fustic and argol is to be gradually reduced; the proportions depend, however, upon the discretion of the dyer; the proportion of sulphate of indigo remains the same, the whole of the blue colouring matter being removed from the dying vessel at each operation.

It is not adviseable to continue more than six parcels of goods without emptying at least one half of the contents of the dying vessels, and filling with fresh water; but shades of olive or brown, must succeed without any addition of water.

For all shades of olive, and brown, which may be considered as the same colour, only varying in the proportions of red, yellow or blue, entering into their compositions: fustic is employed for the yellow, the blue is given by sulphate of indigo; and for the red, madder is used for all the light shades of bronze approaching to green, and

camwood for the darker shades of olive and brown. I shall, without further observation, state some processes.

The light and green shades of bronze, are generally dyed after green, in the same liquor. For 126 lbs. of worsted stuffs after light green, added 24 lbs. of mull madder, 14 lbs. of fustic in chips, 4 lbs. of alum, 3 lbs. of red argol, 2 lbs. of sulphuric acid, and 1 pint of sulphate of indigo; boiled the whole together 10 minutes, added 20 gallons of water, entered the goods, turning quickly, and afterwards more slowly, boiled one hour and thirty minutes, took out the goods and added 3 measured ounces of sulphate of indigo, entered and boiled thirty minutes. With olives, and indeed, all the colours in which sulphate of indigo is employed, except the red brown, it is of consequence that a portion should be added towards the close of the operation; thus increasing the brilliancy of the blue parts of the colour, which is impaired by the long boiling required to fix the yellow and the red.

In the same manner are dyed all the shades of olive, the proportions varying with the colour required; the amount of mordant (alum) and acid employed, must diminish with the number of operations that have been conducted without emptying the dying vessel.

In dying the red shades of brown, for which camwood is used, a different process is employed, the insoluble combination formed between its colouring matter and the base of alum, prevents their being employed together.

For 90 lbs. of worsted goods in fresh water, dyed in a leaden vessel containing 300 gallons of water, added 15 lbs. of rasped camwood, 9 lbs. of rasped fustic, 12 measured ounces of sulphate of indigo, 5 lbs. of red argol, and 3 lbs. of sulphuric acid: after boiling the whole together a few minutes, added 20 gallons of cold water, and entered and boiled 1 hour; the goods had acquired a dull red brown colour—took up, added 6 lbs. of alum, and 3 measured ounces of sulphate of indigo; entered and again boiled one hour; the colour thus obtained, was a bright, full red brown. In the same manner a similar shade of red brown, or others yellower, may be dyed in the same dying liquor, adding the alum after the red part of the colour has become fixed. After the above, a yellow brown approaching to a snuff colour, was dyed; for 100 lbs. of worsted goods added 2 lbs. of camwood, 10 lbs. of mull madder, 9 lbs. of rasped fustic, 3 lbs. of red argol, 14 measured ounces of sulphate of indigo, and 2 pounds of sulphuric acid; boiled one hour; took up, added 4 lbs. of alum, 1 lb. of sulphate of copper, (blue vitriol) 2 lbs. of rasped fustic, and 4 measured ounces of sulphate of indigo; entered, and boiled one hour. A small portion of sulphate of copper increases the brilliancy, and adds much to the intensity of the yellow browns.

The mode of dying olive and brown now described, has only been introduced to the dying establishments of this country since the last 20 years: it is called by dyers, the sour way. The same colours, possessing, however, little brilliancy, were dyed with cam-

wood, fustic, and logwood; the mordant employed was sulphate of iron (copperas.)

For 59 lbs. of a coarse woollen cloth called calmuc, a full olive brown: Dyed in an iron pan containing 400 gallons of water; added 20 lbs. of rasped fustic, 8 lbs. of rasped camwood, 6 lbs. of chipped logwood; boiled 1½ hour; took up, emptied the dying vessel half way, filled with fresh water, and added 2 lbs. of sulphate of iron; entered the cloths, turning quickly 10 minutes, raised gradually to ebullition, and boiled 10 minutes.

In the same manner may be dyed all the shades of copper, brown and olive. [*Annals of Philos.*

Leeds, December 20th, 1826.

Account of a new method of Drawing upon Stone. By M. Laurent, *Painter, Paris.*

Abstracted from the *Ann. de Chim.*

The ingenious process which we propose at present to describe, is taken from a report laid before the Institute by MM. Thenard & De Blainville.

Having taken the outline of the original design upon transparent paper, by tracing all the lines of the original with a dry point, more or less fine, the outline is then glued by its edges upon a board, and there is spread over it, with a piece of fine linen, a sufficiently hard paste, formed with lithographic ink, dissolved in essence of turpentine, which may be made in a spoon, exposed to the heat of a candle. The outline is then rubbed hard with a piece of clean linen, until the linen ceases to have a black tint. The outline is then transferred to the stone by means of a press. For this purpose, M. Laurent places in a vertical paper press, the stone, and the outline in contact, taking care to place above the latter, from twenty to twenty-five sheets of paper wetted in water, and adding in solution some calcined muriate of lime. Upon these last sheets is put a stone, and to prevent any injury, two large plates of paper about an inch thick, are interposed. The pressure is then applied for an hour, and upon separating the stones it will be found that the transparent outlines adheres more or less to the stone. The paper is then removed by hot water, and the design is left upon the stone, which is now washed with cold water, till no trace of the transparent paper remains. There is no fear of the outline dissolving, as the base of the muriate of lime forms, with the oil of the soap, an insoluble soap, while the soda is combined with the hydrochloric acid, and composes a soluble salt, which has been carried away by the washing.

MM. Thenard & Blainville, who highly commend this process, propose the following lithographic ink as superior to any other, viz. soap, one-fourth; mutton suet, one-half; yellow wax, one part; mastic in tears, one-half; and as much lamp-black as is necessary. The whole being melted on a gentle fire, and well mixed, is reduced to

the consistency of a thick cream, by mixing it with equal parts of turpentine and lavender. The commissioners also recommend a thick and straight plank in place of the second stone, and they regard the process as a very valuable one in the arts. [*Brewster's Journal.*

On the subterranean sounds heard at Nakous, on the Red Sea.

Baron Humboldt informs us, on the authority of most credible witnesses, that subterranean sounds like those of an organ, are heard towards sunrise, by those who sleep upon the granite rocks, upon the banks of the Orinoco. Messrs. Jomard, Jollois, and Devilliers, three of the naturalists who accompanied Bonaparte to Egypt, heard at sunrise, in a granite monument placed at the centre of the spot on which the palace of Carnac stands, a noise like that of a string breaking.

Sounds of a nature analogous to these have been heard by Mr. Gray of University College, Oxford, at a place called Nakous, (which signifies a bell) at three leagues from Tor, on the Red Sea. This place which is covered with sand, and surrounded with low rocks in the form of an amphitheatre, presents a steep declivity towards the sea, from which it is half a mile distant. It has a height of about 300 feet, upon 80 feet of width. It has received the name of a bell, because it emits sounds, not as the statue of Memnon formerly did, at sunrise, but at every hour of the day and night, and at all seasons. The first time that Mr. Gray visited this place, he heard at the end of a quarter of an hour, a low continuous murmuring sound, beneath his feet, which gradually changed into pulsations as it became louder, so as to resemble the striking of a clock. In five minutes it became so strong as to detach the sand. The people of Tor declare that the camels are frightened and rendered furious by these sounds.

Anxious to discover the cause of this phenomenon, which no preceding traveller had mentioned, Mr. Gray returned to the spot next day, and remained an hour, to hear the sound, which was on that occasion heard much louder than before. As the sky was serene, and the air calm, he was satisfied that the sound could not be attributed to the introduction of the external air, and in addition to this he could not observe any crevices by which the external air could penetrate. The Arabs of the desert ascribe these sounds to a convent of monks preserved miraculously under ground, and they are of opinion that the sound is that of their bell. Others think that it arises from volcanic causes; and they found this opinion on the fact that the hot baths of Pharaoh are on the same coast.

M. Humboldt ascribes the sound in the granite rocks, to the difference of temperature between the external air, and the air of the narrow and deep crevices of the shelves of rocks. These crevices, he informs us, are often heated to 48° or 50° during the day, and the

temperature of their surface was often 39°, when that of the external air was only 28°. [*Edinburgh Journal of Science.*

Remarks by the Editor.—Without attempting to add any thing to the conjectures respecting the cause of the sounds mentioned in the above article, we think that the fact of their existence furnishes a very probable solution of the origin of the sounds emitted by the celebrated statue of Memnon in Egypt. There is, we think, a striking analogy in the nature of the sounds, as above described, and those which it is said were omitted by the statue, which we are told "had the wonderful property of uttering a melodious sound every day at sun rising, like that which is heard on the breaking of the string of a harp when it is wound up. This was effected by the rays of the sun when they fell upon it. At the setting of the sun, and at night, the sound was lugubrious."

The probability that a place would be selected for the erection of such a statue, where such sounds were naturally produced, is so great as not to require insisting upon; and, in the absence of any certain mode of explaining the phenomenon, it removes the difficulties which have presented themselves in accounting for the sounds by the action of the solar ray on any mechanism contained in a statue of stone.

Mr. Steart's process in manufacturing the Lino-stereo Tablets.

THE extra stout drawing-papers, or card boards as they are usually denominated, are always made by pasting several sheets of paper together in the manner of a common pasteboard, and afterwards bringing them to a smooth face by pressing and rolling. The pasting is a dirty operation, and the occasion of many defects, some of which are fatal to the degree of perfection and nicety required in a good drawing-board. Another great defect is, that the far greater part of the drawing and writing papers now in use in this country, are of a hollow or spongy texture; this arises from their being made of an indiscriminate mixture of linen and cotton; the greater elasticity of the latter, preventing its fibres from closely uniting with those of the flax; the consequence is, an irregular surface, and a porous spongy substance, very different from that which an adherence to the good old-fashioned practice of using fine linen rags only, in the manufacture of superior papers, would produce.

The lino-stereo tablet is entirely free from these objections, for the following reasons:—first, it is not composed of several sheets pasted together, but is moulded from the pulp of any required thickness, in one entire mass; thus the risk of pasting is avoided, and no separation of the component parts can possibly take place, though wetted ever so often: secondly, instead of being composed of linen and cotton, it is wholly and solely manufactured from the best and purest white linen rags, most carefully selected; and, consequently,

without the aid of the chloride of lime, or any bleaching process whatever.

The process.—In selecting the raw materials for the manufacture of the lino-tablets, great care is taken to preserve the *best and purest white linen* rags only, rejecting all muslins, calicoes, and every other article made of *cotton*. The linen rags are then carefully sorted, overlooked, and cleaned, washed and beaten into pulp in the usual manner practised by paper-makers of the first class.

The pulp being ready, and diluted in the vat with the proper proportion of pure water, the workman, dipping his mould first into the vat, takes it up, filled with pulp to the top of the deckle; and holding it horizontally, and gently shaking it, causes the water to subside, leaving the pulp very evenly set upon the face of the mould; having rested it for a moment or two in the bridge of the vat, the compresser with its face downwards, is now carefully laid upon the sheet or tablet, and both together placed in a small press close at hand, where it is submitted to a very gentle pressure, in order to exclude a great proportion of the water remaining in the sheet; it is then withdrawn, the compresser and the deckle are both taken off, and another workman couches it, by very dexterously turning the mould upside down, and pressing it pretty hard with his hands on one of the fine felts previously laid upon a very level pressing plank, by which means the tablet is left on the felt. The mould is then returned to the vatman, who repeats the process as before. The coucher, in the mean time, lays another felt upon the sheet or tablet just couched, whereon the second sheet is to be laid in the same manner; and so on, until all the felts are occupied; over which another level plank is placed, and the whole drawn away, on a small rail road wagon, to the great press, where it undergoes a pretty severe pressure.

The tablets will now be found to have sufficient adhesion to bear handling with care, and are separated from the felts, and placed one upon another, so as to form the packs: these packs are to be submitted again to the action of the press, until more water is expelled; then are parted sheet by sheet, pressed and parted again; and this is repeated as often as necessary, taking care to increase the pressure every operation, until the face of the tablets is sufficiently smooth: they are then carefully dried, sized, picked, sorted, &c.; carried to the rolling mill, and several times passed between the polished cylinders, to give them the last finish.

The above is the process for the plain or white tablets. In making the tinted tablets, the following additional particulars are to be attended to:—

The rags are cleansed, washed, and beaten into half stuff, in the usual way; the water being drained off, the pulp is put into a vat with a solution, in water, of acetate of alumine, or sulphate of iron, as a mordant or ground to fix the colour intended to be made; the whole is well incorporated, and suffered to remain for half an hour or more, when the colouring tincture, previously prepared, is added; after which, the whole being returned to the engines, is beaten into fine pulp, and then wrought into fine tablets.

The dying materials chiefly made use of by Mr. Steart, are, mangrove bark, quercitron bark, best blue Aleppo galls, sulphate of iron, and acetate of alumine. A due combination of these materials produces a great variety of drabs, grays, sand-colours, &c.

[*Abrid. Tran. Soc. Arts.*

On Etching and Dying Figures on Ivory, at one operation.
By Mr. J. Cathery.

From the Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce.

The usual mode of ornamenting ivory in black, is to engrave the pattern or design, and then to fill up the cavities thus produced, with hard black varnish. The demand for engraved ivory in ornamented inlaying, and for other purposes, is considerable, although the price paid for it is not such as to encourage artists of much ability, to devote themselves to this work, which consequently is trivial in design and coarse in execution. Mr. Cathery's improvement consists in covering the ivory with engraver's varnish, and drawing the design with an etching needle; he then pours on a menstruum composed of one hundred and twenty grains of fine silver, dissolved in one ounce measure of nitric acid, and then diluted with one quart of pure distilled water. After half an hour, more or less, according to the required depth of tint, the liquor is to be poured off, and the surface is to be washed with distilled water, and dried with blotting paper; it is then to be exposed to the light for an hour, after which the varnish may be removed by means of oil of turpentine. The design will now appear permanently impressed on the ivory, and of a black or blackish brown colour, which will come to its full tint after exposure for a day or two, to the light.

The property which nitrate of silver possesses, of giving a permanent dark stain, to ivory and many other substances, has been long known; but Mr. Cathery has the merit of having advantageously applied it in a department of art in which it is likely to be of considerable service, by improving the quality of the ornament, and at the same time of diminishing the cost. Varieties of colour may also be given, by substituting the salts of gold, platina, copper, &c. for the solution of silver.

Improvement in the manufacture of Magnetic Needles.
By Prof. Amos Eaton.

TO PROF. SILLIMAN.

Several years of the early part of my life were devoted to an extensive land agency, among the western and northern spurs of the Catskill mountains. During this period, I ran most of the outlines of two hundred thousand acres, besides four turnpike roads across

this Alpine district. The difficulties to which I was almost daily subjected, by the irregularity of the magnetic needle, were often very embarrassing. The old surveyors of that time assured me, that these fits, as they denominated those irregularities, were produced by the action of magnetic ores, which they believed abounded in this mountainous district. At one time I entertained the opinion, that I had collected facts sufficient to demonstrate, that while snow was melting away, these fits were the most frequent.

But on comparing different compasses, I found that they frequently varied, not only from the common direction of the magnetic needle, but from each other. For example, when set in some directions, one compass would vary, while other compasses would vary when set in different directions, and would not vary when set in the same directions. On extensive alluvial plains, where we could not suspect the presence of extensive ore-beds, all these difficulties occurred with equal force. And what appeared to be a still greater mystery, on changing needles, the variation seemed to be governed by the compass, not by the needle.

After considering every proposed hypothesis, and trying every proposed remedy, I abandoned the subject as totally inexplicable; and contented myself with correcting these aberrations by ranging back-flags and using two compasses.

While exercising the students of Rensselaer school in land-surveying, at the last summer term, the same difficulties revived the same enquiries. In a conversation with an ingenious artist, Mr. Julius Hanks of Troy, I learned that his best compasses had in some instances, been subject to those fits of aberration. He showed me a compass of most elegant and accurate workmanship, with a nonius and double levels, which had been returned by the purchaser on account of the frequency of those fits. I carried this compass to the school with a determination to search out if possible, the cause of its frequent fits. By applying delicately suspended needles, which might be called a suit of magnetrometers, I found a point in the limb, which attracted a fine needle at the distance of six tenths of an inch. This point, caused the needle belonging to the compass, to deviate at the distance of half an inch on each side; beyond that limit it was not affected. Consequently, when the course to be taken, brought the needle within that limit, it would deviate, and point accurately in all other directions. Any practising surveyor will readily perceive, that in tracing the lines around a field, the needle might come within this limit several times, or it might not fall within it in running a dozen fields. Hence the supposed irregularity of the fits.

My conclusions from these experiments were, that a scale from a screw-cutter or a punch, or a tooth from a file, &c. too minute for the eye, might have been lodged in that particular point. On consulting Mr. Hanks, he said this might frequently happen, and it was not improbable that all those fits complained of by surveyors, might be traced to the same cause; inasmuch as all compass cards and graduated circles were wrought with very fine steel instruments. To illus-

trate the subject, I took out the screws from the under side of the card, and inserted the point of the finest sewing needle, less than the twentieth of an inch in length; whereby I actually produced four additional points of disturbance.

To obviate the difficulty, Mr. Hanks cut off seven tenths of an inch from each pole of the needle, ground the poles to very sharp points, and tipped them with brass caps, extending to the original length of the needle. This measure, by withdrawing the magnetic poles from the sphere of attraction, proved a perfect remedy. Mr. Hanks presented the same compass to the school, where it has been used almost daily for two months; and it is one of the most perfect instruments that I have ever used. It has no more fits, and is totally undisturbed by magnetic ores, real or imaginary. Mr. Hanks has since corrected a theodolite in the same way, which had been thrown aside as useless for several years. If the disturbing steel scale is in the card near the graduated circle, Mr. H. proposes lengthening the pivot and raising the circle by introducing an additional circle beneath the graduated one. But he has not made this experiment; and it is probable no such case will ever occur. For if it were near the pivot, it would not disturb the needle; and so little work is required in the card with slender instruments, that scales will not often be left in that part.

Another important advantage which will attend tipping needles with silver, brass, &c. is that of preserving the points from rust. It has been demonstrated by conclusive experiments, that magnetism resembles electricity in acting most powerfully from the sharpest points. Hence the absurdity of needles made of square bars. Hence, also, the utility of preserving the finally sharpened points by tips. I will add, that, of all forms of needles which I have used, the flat kinds are best, which are wide in the middle, and of a true taper to the points.

Yours respectfully,

AMOS EATON.

Rensselaer School, Troy, N. Y., Nov. 1826.

[*Silliman's Journal.*

CINCINNATI IN 1826.

We have just received a very interesting pamphlet of 100 pages, under the above title, written by B. Drake, and E. Mansfield, Esqrs. of that place. The facts which it details have been collected with great industry, are skilfully arranged, and well narrated. The 7th and 8th chapters, which present a view of the population and manufactures of Cincinnati, we now present to our readers, and shall prepare for our next number, a general abstract of such other portions of the work, as may come most directly within the scope of our pages.

Population in December, 1826.

		First Ward.	Second Ward.	Third Ward.	Fourth Ward.	Total.	
Males,	Over 21,	970	1591	739	833	4133	7990
	Under 21,	983	1634	535	705	3857	
Females,	Over 18,	935	1636	613	761	3945	7550
	Under 18,	855	1583	501	666	3605	
	Blacks,	341	55	117	177	690	
	Total	4084	6499	2505	3142	16230*	

The average number of persons to a building, is six and a half. The actual density of *habitation* is much greater, from the fact, that a large portion of the buildings is occupied as stores, ware-houses, &c. &c.

There are within the city, at this time, about 28 Clergymen, 34 Attornies and Counsellors at Law, and 35 Physicians. It is estimated, that 800 persons are employed in Trade and Mercantile pursuits; 500 in Navigation; and about 3000 in Manufactures.

Comparative Population.

The following table is submitted, that the progressive increase of Cincinnati may be fairly exhibited, and the means furnished for comparing its advancement and prospects, with those of the most flourishing towns in the United States.

The first settlement of Cincinnati, was in 1788. The population did not increase, however, with any rapidity, till 1805, when it had scarcely attained the importance of a large village. A considerable number of emigrants then came out from Baltimore, and other eastern places; and from that time to the present, its growth and consequent prosperity has been remarkable, even in this astonishing age and country.

In 1810, the population was 2,320—1813, 4,000—1819, 10,283—1824, 12,016—1826, 16,230.

From this, it appears that the *ratio* of increase from 1810, to 1813, was 560 per annum, or 24 per cent.; from 1813 to 1819, 1043 per annum, or 26 per cent.; from 1819 to 1825, 364 per annum, or 3½ per cent.; from 1824 to 1826, 2107 per annum, or 17 per cent. The *ratio* of increase, *decreases* every where, as it respects population, with the *actual increase;* hence, though a new village may double in a single year, a large city, in its highest state of prosperity, scarcely attains an addition of 5 per cent. The operation of this principle being considered, the growth of this place, during the last two years, has been greater than that of any former period.

The relative population of several towns nearest in size to Cincinnati may be seen from the following table.

* The number of inhabitants, as here stated, may appear to those who have not attentively marked the progress of Cincinnati, as too *great*. The authors, with a view to accuracy on this important topic, made the enumeration in person. They feel confident, therefore, that the actual number in this city *exceeds* that given in the above table.

Providence		Albany.		Pittsburgh & Liberties.	
In 1800,	7,614.	In 1791,	6,021.	In 1810,	4,768.
1810,	10,071.	1810,	9,356.	1820,	7,243.
1820,	11,767.	1820,	12,650.	1826,	11,226.
1825,	16,000.	1825,	15,500.		

Richmond.		Louisville.		New-Orleans.	
In 1800,	5,537.	In 1820,	4,012.	In 1802,	10,000.
1810,	9,755.	1826,	7,200.	1810,	17,242.
1820,	12,046.			1820,	27,176.

Manufactures.

The Artizans and Manufacturers of Cincinnati, who may be said to constitute the bone and sinew of the community, and upon whom the permanent prosperity of our city so materially depends, considered as a body, may be characterized as frugal, ingenious, and enterprising.

The number of our manufacturing establishments has greatly increased within the last two years, and the amount of productive industry for 1826, as will appear from the following statements, although not so great as could be wished, is by no means inconsiderable. The general prosperity of these establishments is beginning to attract the attention of capitalists, and is likely to augment their number. Indeed the Mechanics and Manufacturers of Cincinnati are decidedly the most *prosperous* class of citizens; and were the enterprise and capital of some of our merchants, embarked in similar pursuits, they would profit by the exchange. In this department, there is no danger, as in commercial pursuits, of running into excess. The region of country, which extended and successful manufacturing establishments will make tributary to our city, like the amount of manufactured goods required by its wants, is almost unbounded. Our Steam Boats may already be found upon all the navigable streams of the Mississippi valley: and our Steam Engines, Castings, Cabinet Furniture, Chairs, Hats, &c. &c. are sent to Kentucky, Alabama, Louisiana, Mississippi, Illinois, and Indiana, where they are sought after and admired, not less for their beauty, than their more substantial qualities. The inducements and peculiar facilities for our becoming a manufacturing people in this city, will be more fully discussed in a subsequent chapter of this book.

The following items, in regard to the manufactures of Cincinnati for 1826, have been collected with no small degree of labour, and with an earnest desire of having them as conformable to correctness as the nature of the case will permit. The following brief notices of some of the more prominent manufacturing establishments, will not, it is hoped, be deemed unimportant.

The Cincinnati Steam Mill, stands on Front between Ludlow street and Broadway. It is a substantial stone building, based upon the limestone rocks of the river, 62 by 87 feet, eight stories high, on the end next to the river, and measuring 110 feet from the base to the top of the roof. It has 24 doors and 90 windows. It required in its construction 6,620 perches of stone; 90,000 bricks; 14,000 bushels of

lime: and 81,200 cubic feet of timber. With the exception of the walls, this immense building was entirely consumed by fire in 1823. It has since been rebuilt, and is now in operation. It contains a manufactory of flour, a distillery, fulling mill, &c. The machinery is driven by a steam engine of 70 horse power. The establishment is capable of manufacturing 20,000 barrels of flour, 500 barrels of whiskey, and of fulling 1,000 pieces of cloth, annually.

Steam Mill for Sawing Stone. This establishment has just been made in the western part of the city, between Front and Columbia streets, and is owned by Mr. Alvin Washburn. The main building is 32 by 50 feet, 3 stories high, with one wing 20 by 40 feet, and is built of wood. It has a steam engine of 18 horse power. The first story is occupied with the machinery for sawing *free stone*. From the experiments already made, the proprietor feels confident of being enabled to saw 120,000 feet of stone per annum; and upon such terms as to make a signal reduction in the price of that important and beautiful material for building.

The second story contains machinery, driven by the same power, ingeniously contrived for the manufacture of tubs, buckets, and kegs, out of solid logs. About 30,000 of these will be produced annually.

In the third story the manufacture of *shoe trees* is carried on, the machinery for which is also propelled by the same power. About 50 *lasts* per day can be made, requiring the labour of but four hands.

The Phœnix Foundry, owned and carried on by C. Tatem & Sons, is situated west of Walnut Street, between Third and Fourth. It gives employment to 18 hands; and about 175 tons of pig iron are annually manufactured into various kinds of machinery, such as steam engines, mill castings, &c. &c. The establishment consumes annually, about 7,000 bushels of pit coal.

The Franklin Foundry, is situated at the corner of Fifth Street and Broadway. It employs 10 hands, and manufactures annually, into the various kinds of castings, about 100 tons of pig iron. It is owned by the Messrs. M'Cormicks.

The Eagle Foundry, owned by Josiah Hawkins, is situated on the south side of Fourth Street, between Main and Walnut. It employs 14 hands, and uses 150 tons of pig iron per annum; besides about 5 tons of bar iron, a considerable portion of which is manufactured into ploughs. The establishment consumes annually about 4,000 bushels of pit coal.

Tift's Steam Engine and Finishing Establishment, employs between 30 and 40 hands. The business is carried on in a new frame building, of large dimensions, situated on Columbia Street, east of Broadway. The upper apartments of the building are intended for the reception of an extensive cotton spinning establishment, which Mr. Tift, with his characteristic enterprise, is now forming.

R. C. Green's Steam Engine Establishment, which is similar to that of Mr. Tift, is situated on Front Street, just below Deer-creek Bridge.

Goodloe & Harkness' Copper Foundry, Cotton Spinning, and Steam Engine Factory, stands at the corner of Broadway and Con-

gress Street. It employs about 50 hands. The cotton spinning department contains about 336 spindles, which produce about 600 lbs. of cotton yarn per week, or 31,000 pounds per annum.

The Ætna Foundry, owned by Street and White, is situated on Front Street, below Deer-creek Bridge. It employs about 12 hands, and manufactures 220 tons of castings per annum.

Kirk's Steam Engine and Finishing Establishment, is situated on Columbia street, east of Broadway. It employs about 15 hands.

Shield's Engine Finishing Establishment, is situated in a stone building on Sycamore, between Front and Columbia streets. It employs about 30 hands.

Allen & Co.'s Chemical Laboratory, which has recently been commenced, is situated just above Deer-creek Bridge. It embraces the manufacture of Alum, Blue Vitriol, Copperas, Nitric and Sulphuric Acid, and other Chemical preparations. It will make from one to two tons of Alum per week. The Alum-earth is obtained from the hills of the Ohio river, near the mouth of the Scioto, where there are vast beds of it.

Powder Mill. An extensive and well planned establishment for the manufacture of Powder, has been made within the present year, by some gentlemen of this city, immediately below the mouth of Mill-creek. The machinery is driven by a Steam Engine, so arranged as to prevent any danger from fire. This is the only establishment of the kind within the state, and from the facilities of obtaining at this place, the raw materials, used in the manufacture of powder, it will no doubt be found a profitable business.

The Phœnix Paper Mill. During the past summer, a fine establishment for the manufacture of paper was erected under the superintendence of the Messrs. Grahams, on the river bank, in the western part of the city. When about to go into operation, in the month of December, it was entirely consumed by fire. The owners of it are now erecting upon its ruins another, to be called the Phœnix Paper Mill, which is 132 by 36 feet, exclusive of the wings. Its machinery will be worked by a substantial steam engine, and probably go into operation by the first of June.

The Cincinnati Steam Paper Mill, owned by Messrs. Phillips and Spear, is on the bank of the river in the western part of the city. The building is 140 by 34 feet. The machinery is driven by a steam engine. The establishment employs about 40 hands, and produces annually a large quantity of excellent paper.

The Woollen Factory, erected several years since, by the Cincinnati Manufacturing Company, stands on the river bank, above the mouth of Deer-creek. The main building is 150 feet long, and between 20 and 37 feet wide. It is calculated for the manufacture of woollen goods, white and red lead, linseed oil, &c. The operations of this establishment are, for the present, suspended.

The Sugar Refinery, is a large brick building, erected for the purpose, situated north of Third, and between Ludlow street and Broadway. When in full operation, it is capable of refining about 180,000

pounds per annum. There has been but a small amount of sugar refined in it during the present year.

The White Lead Factory, owned by T. Clayland & Co. and the only one in the city, is situated at the east end of Fifth street. It employs three hands, and will hereafter manufacture about 1,500 kegs of white lead per annum. The principal supply, however, of this article is drawn from Pittsburgh,—a fact worth the attention of capitalists. The metal from which this article is produced, is carried past our city, and against the current of the stream, 460 miles to Pittsburgh; and over land, 84 miles to Lexington: at these places it is converted into white lead, and returned to Cincinnati. In either case, the necessary expenses of transportation, would be a handsome profit for the manufacturer in this city.

The Messrs. Wells' Type Foundry and Printers' Warehouse, is situated on Walnut street, between Third and Fourth, where they manufacture in a superior manner, all kinds of type, presses, chases, composing sticks, proof gallies, brass rule, &c. &c., at the eastern prices. They employ about 23 hands. This valuable establishment has entirely superseded the importation of type and other printing materials, from the eastern states.

There are in the city, three permanent Boat Yards for the construction of steam-boats, besides one or two others, in which they are occasionally built. The regular establishments are owned by Gordon, Parsons, and the Messrs. Weeks. During 1826, there were about 200 hands employed in this business. The reputation of these Yards, is superior to that of any on the western waters.

The manufacture of Hats in this city, is carried on to a very considerable extent, many of which are exported. Our Hatters not only select the best furs that are offered in the west, but also make importations from the eastern states. Some of the most substantial, and elegantly finished hats that we have ever seen, were from the Messrs. J. Coombs' and A. W. Patterson's establishments in this city.

The Cabinet Furniture and Chairs, manufactured in Cincinnati, are of the most beautiful kind, and will compare with those produced in any part of the Union. Considerable quantities of these articles are exported to the states west and south of Cincinnati.

There are nine Printing Establishments in this city, which print about 7,200 newspapers per week, or 175,000 per annum. There have been printed at these offices, within the year 1826,—61,000 Almanacks, 55,000 Spelling Books, 30,000 Primers, 3,000 Bible News, 3,000 American Preceptors, 3,000 American Readers, 3,000 Introduction to the English Reader, 500 Hammond's Ohio Reports, 500 Symme's Theory, 3,000 Kirkham's Grammar, 1,000 Vine-Dresser's Guide, 14,000 Pamphlets, 5,000 Table Arithmetics, 2,000 Murray's Grammar, 1,500 Family Physician, 14,200 Testaments, Hymn, and Music Books.

There is no Umbrella Factory in this city. Of the success of an establishment of this kind, there can be no doubt.

The value of Manufactured Articles, or in other words the produc-

tive industry of the Artizans and Mechanics of Cincinnati, for the year 1826, will appear from the following table.

Five Steam Engine and Finishing Establishments, employing 126 hands; value of manufactured articles,	$134,000
Four Iron Foundries, 54 hands,	59,400
Eleven Soap and Candle Factories, 48 hands; (451,000 pounds of soap, and 332,000 pounds of candles,)	51,500
Ten Tanneries and Currying Shops, 66 hands,	76,500
Thirteen Cabinet Furniture Shops, 104 hands,	67,950
Four Rope Walks, 31 hands,	23,000
Two Breweries, 18 hands,	20,900
Seven Hatters' Shops, 95 hands,	123,200
Twenty-nine Boot and Shoe Shops, 257 hands,	88,550
Two Wall Paper Factories, 9 hands,	8,400
Ten Saddlers and Trunk Makers, 66 hands,	41,900
Three Tobacco and Snuff Factories, 28 hands,	21,200
One Brass and Bell Foundry, 4 hands,	5,500
Nine Tin and Coppersmiths' shops, 39 hands,	48,800
One Oil Mill, 7 hands,	11,700
Two Woolcarding and Fulling Mills, 11 hands,	6,500
Six Chair Factories, 38 hands,	21,973
Three Turners in Wood, 9 hands,	2,925
Eleven Coopers' Shops, 48 hands,	29,700
One Type Foundry, 23 hands,	20,000
One Clock Factory, 18 hands,	20,000
Three Plough Factories, 11 hands,	10,475
Eight Carriage and Wagon Factories, 37 hands,	26,280
Two Potteries, 8 hands,	4,500
Two Woollen and Cotton Factories, 6 hands,	4,100
Two Boot and Shoe Tree Factories, 5 hands,	1,100
Two Plane Stock, Bit, and Screw Factories, 7 hands,	11,145
Two Comb Factories, 6 hands,	1,600
One Looking-glass and Picture Frame Factory, 7 hands,	2,000
One Sieve Factory, 3 hands,	3,400
One Chemical Laboratory,	2,400
Six Book Binderies, 14 hands,	11,971
Seven Silversmiths' Shops, 17 hands,	8,600
Ten Bakeries, 28 hands,	29,400
One Paper Mill, 40 hands,	22,000
Twenty-one Smiths' Shops, 92 hands,	48,000
Five hundred Carpenters,	165,000
Thirty Painters,	13,900
Thirty-five Tailors' and Clothiers' Shops, employing 132 men, 467 women,	172,815
Fourteen Brick Yards, 210 hands, (10,000,000 of Bricks,)	25,000
One Cotton Spinning and Brass Foundry, 21 hands,	22,000
One Matrass Factory, 3 hands,	1,000
One White Lead Factory, 3 hands,	3,672
Four Stone Cutting Factories, 18 hands,	11,100
Three Steam-boat Yards, 200 hands,	105,000

Nine Printing Establishments, 58 hands,	52,000
One hundred and ten Brick-layers, Stone-masons and Plasterers,	37,650
One Distillery, 2 hands,	4,300
	1,682,000

From the following establishments and artizans no returns have been received: 1 Sugar Refinery; 3 Copper-plate Engravers; 3 Portrait and 1 Miniature Painters; 1 Cotton and Wool Card Factory; 1 Steam Saw Mill; 4 Carpet and Stocking Weavers; 2 Steam Flour Mills; 1 Powder Factory; 2 Crockery and Stone-ware Factories; 1 Carver in Wood; 40 Milliners-shops; 2 Brush Makers; 1 Wheat Fan Factory; 1 Pump and Block Maker; 1 Saddle-tree Maker; 4 chemical Laboratories; 1 Sash Maker; 2 Blacksmiths; 2 Piano Factories; 1 Organ Builder; 5 Shoe-makers; 2 Tailors; 1 Distillery; 2 Upholsterers; 1 Cutler; 9 Confectionaries; 2 Gun-smiths; 3 Lime Kilns; 2 Bakeries.

From the best data which can be obtained, the value of the articles produced in these Factories and Shops is not less than 100,000

In addition to the above may be added Pugh and Teater's Glass Works, at Moscow; Duval's Paper Mills at Mill Grove; and 3 Cotton Spinning Factories, all of which are owned by citizens of Cincinnati, and the manufactured articles from which, are sold in this city. The value of the products from these establishments may be safely estimated at 68,000

$1,850,000

Observations upon the present Mode of Paving, in London, with a Plan for its Improvement.

HAVING observed that the present system of paving works badly, and imagining that it admits of easy and effectual remedy, by which economy and general convenience might be durably attained, I would first point out the following as its chief

Imperfections.—The *nature* and *state* of the soil in which the paving stones are placed.

The wedge-like form of the stones.

The great distances between them at their lower surface.

The frequent disturbance of them for the repair of pipes and sewers.

On a comparison of these imperfections I would observe, that while the present soil is continued as a substratum so readily softened by water, and dug up loosely as though to facilitate the stones driv-

ing into it at regular depths, neither the biangular, the block, nor any other pavement, ancient or modern, will prevent its rapidly acquiring an uneven and muddy surface, as a permanent support can only be obtained either perpendicularly, by a substratum nearly unyielding, or diagonally by buttresses; the latter being impracticable from the expense it would involve, the cellars it would force in, and the old houses it would tumble over our heads, leaves the alternative of obtaining a good substratum of road on which to place the pavement; which I propose to obtain by the following

Plan.—Let the stones be for the present removed. The soil, to the depth of eight inches, sifted, the fine portion sent off altogether, the coarse retained for the road; but, before spreading, the sub-soil should be dug and raked, to bring the coarse material to the surface, which should be covered by that obtained from screening, and a surface added of about three inches of such of the present pavement, properly broken up, as are totally unfit for tolerably good pavement. When sufficiently worn, I would add three inches of the same material; so far it will be seen I propose to form a Macadamized road, on which, as soon as it had acquired by raking and wear a uniform and solid surface, I would, without scraping it, lay paving stones of equal depth and width, and as square as they could be obtained, consistent with economy, introducing the large end downwards where there was any approach to a wedge-like form, always remembering to place the lower surfaces of the stones in close contact, both at sides and ends, and that no two joints should follow in continuity. I would then ram into the interstices such thin chippings of granite as might fit them, and wash in scrapings from a granite road, or any cheap body of more cementing properties, and which would be as little effected by changes of temperature. This plan would require for the sub-road the bulk of the present pavement, leaving a few of those most uniform in depth, and least wedge-like in form, to be introduced, the large end downwards, in a length of street unmixed with the new pavement, yet treated in the same manner.

Pipes should be laid as close to the curb as possible, where the traffic is least; and whenever the ground is filled in after repair of pipes or sewers, it should be well rammed throughout its depth; and no soil that would be readily acted on by water should be allowed within eighteen inches of the surface.

It will be allowed that a wedge, either of stone or wood, is adapted to drive into soft ground; and though a pavior may force it pretty hard, it will not stop there; for if the maximum of force from a pavior's rammer be equivalent to 5 cwt., (a large estimate) it must be expected that a wheel, conveying a weight of a ton and a half, must needs drive further; and more especially where, by holes already formed, the weight and impetus will frequently amount to more than two tons from a single wheel.

Common earth and rubbish readily mix with water: thus mud must be formed under the pavement in wet weather, which, passing off through the needlessly wide interstices, occasions a rapid accu-

mulation of mud on the surface, and makes room for the descending stones, some of which, being on softer ground, or more wedge-like in form, or smaller, or placed originally lower than those next to them, sink more; a reservoir is thus formed for the rain, which sinking into the ground and forming mud, the wheels which pass with increased force into such holes enlarge and deepen them. The deeper the hole, the greater the force of the descending wheel, and the longer the continuance of the reservoir to mix with the earth; so that the evil increases in a two-fold ratio.

This plan would, I think, realize the following

Advantages.—The sub-soil or road would no longer yield mud, nor allow the wider and flatter surfaces of the stones to pass into its hard and level surface, and form holes in the pavement.

Horses and carriages would all be adequate to more work, with less expenditure of strength and soundness. Indeed, the great mass of suffering endured by the inflamed joints of, perhaps every hackney coach horse, should of itself induce humane persons to promote some reasonable plan to remove the cause of it; and the quantum of suffering borne by other carriage and saddle horses must be very considerable.

The inconvenience and danger to riders and their horses would be much diminished.

Commerce, and the various objects of passengers of all descriptions, would seldom be interrupted by the mending of pavements.

Even the footpaths, freed from the abundant supply of mud from the carriage-road, would be much cleaner.

The sewers would, probably, never need cleaning, and being permanently more free from mud, would contribute more even than they now do to the health of the inhabitants.

I by no means think that this plan would produce a perfect road; but I believe that it would be more permanently level, durable, clean, and economical, than has ever been seen in any much-worn street of this metropolis.

I have calculated that permanently-good paving in London, Westminster, and Southwark, would save, in the wear of horses and vehicles of all descriptions, not less than one hundred and forty thousand pounds per annum; besides that fewer horses, and somewhat lighter carriages, would be adequate to the work required. Should this become apparent, the interest of brewers, coach-masters, coal merchants, and the poor hackney-coachmen, would be materially served; and every humane person rejoice at the great reduction in the sufferings of the most noble of quadrupeds.

I wish also to suggest the following observations on the adaptation of Macadam's roads for the chief thoroughfares of this metropolis.

It would seem that for a road not extremely used, this plan is far preferable to any other yet introduced; but such is the rapid wear by pulverization, of granite and all other brittle substances, and so slowly do they yield to mere friction, that I apprehend where the road would wear ten inches in a year, the well-paved street would

not yield more than one fifth of an inch in the same period, after the first wear of the sharp edges of the stones, which with close joints would be very trifling.

A Macadamized road, if much used, requires such constant watering in dry weather to keep it together, and in wet, wears so rapidly, especially on the level streets, and those running east and west, thereby being shaded by the houses to the south, that a constant expense is entailed either way.

If any doubt the great difference in the destructive properties of pulverization and friction on brittle substances, it may be well to notice the patent illuminators for ships' decks, which last generally for many years unaltered, except by some scratches on their upper surface; yet were any one of them to be broken into twenty pieces, so as to render them, by their size and shape, liable to pulverization, there is not one of them but would be ground to powder by a thousandth part of what some of them have borne.

GEORGE KNIGHT.

Norway Wharf, Limehouse.

[*Journal Royal Institution.*

FOR THE FRANKLIN JOURNAL

On Paper for Records, and other Legal Instruments of Writing.

THE subjoined letter from a distinguished member of the Philadelphia bar, to Peter A. Browne, Esq., sufficiently explains the importance of the subject to which it refers. It was designed to call the attention of the Committee on premiums, of the Franklin Institute, to a point of such general moment; the letter, however, was not received until that committee had completed the list of premiums for the present year, and it is probable that the desired object may be more effectually attained through the medium of the Journal, than by the offering of a premium. In the latter case, a paper maker might make a few reams which might merit the premium, without affording that supply which it is so desirable to obtain.

To us it appears that it would be the undoubted interest of one of our best paper makers to furnish a regular supply of paper made specially for the purpose of legal instruments of writing, of such a texture as would possess all the qualities desired. Its use would be extensive, as it would undoubtedly be adopted in the public offices, as well as by the members of the bar, and a price could readily be obtained, which would amply remunerate the maker.

The principal danger to be apprehended, is from the deterioration in quality, which we so generally witnessed in articles, after they have obtained possession of the market. Whenever the manufacturer concludes that something a little inferior will do *well enough*, he has taken that step which will eventually destroy public confidence, and consequently defeat his own object. There are, however, men of skill in the business, who know how to produce the article wanted, and whose characters stand sufficiently high to inspire confidence in

a pledge, that they would continue to furnish such paper, of a uniform quality. We have in the market, some beautiful paper for folding maps, uniting the qualities of a good surface, toughness, flexibility and body, with that lightness of texture which is desired for that purpose; and we apprehend that it is in the power of the same workmen to produce a thick paper of equal excellence.

We would gladly aid in the attainment of the object, by offering our journal as a medium of communication from manufacturers and others interested in the business.

Philadelphia, March 1st, 1827.

Dear Sir,—A knowledge of the interest you take in every thing connected with our domestic manufactures, induces me to call your attention to the writing paper used in this city for general purposes, but more especially to that used by the bar, and in the public offices. I have observed for a period of eighteen months past, that it was very difficult to obtain good writing paper of the manufacture of Pennsylvania; and that with a single exception, that of Mr. Amies, it was of inferior quality.

The effect of using inferior paper for legal instruments, records, &c. is well known to those whose pursuits often oblige them to sort, with great pains, the disjointed pieces of an important document, on which may depend the fortune of an individual; or who see a declaration requiring the assistance of wafers to hold it together, before the cause in which it is filed, can be reached and tried.

With a view to satisfy myself upon the subject, I have taken the pains to examine the dockets of the supreme court, and of the common pleas of this county, and have found the earlier records in good preservation, although some of them are nearly one hundred years old. The quality of the Dutch paper, upon which the earlier records are written, and that of the English paper, which was used at a more recent period, has enabled them to withstand the effect of time much better than I have reason to believe any of the qualities of paper, now manufactured in Pennsylvania, would be found to do. Indeed many of us may expect, if we reach the ordinary age allotted to man, to outlive the records we contribute to furnish, unless we adopt a more lasting material.

I am, however, not without hopes, that if the subject be brought before the Franklin Institute, the paper of Pennsylvania would in a short time rival Whatman's, or the celebrated Blauw paper. And I am very desirous to see what would be produced by the offer of a premium for the best quarto post writing paper, and of the best cap paper, prepared solely for instruments of a legal nature.

I need scarcely remind you, my dear sir, that the use of the same kind of paper by the profession, would much facilitate the performance of some of the duties in the public offices connected with the administration of justice—it being well known that the difference in size of the sheets, causes the clerks great trouble, and often occasions the loss of part of the record. With a view to prevent any difficulty of the kind, it is the regulation, as I am informed, of some of the public

offices at Washington, that no communications of a particular nature are to be received, unless written upon paper of a certain size. In England all law papers and documents, are upon the same kind of paper.

I shall feel much gratified, should you deem this subject of sufficient importance, to have the attention of the Institute called to it: for I do not remember to have seen, at the last exhibition, among the numerous and striking proofs of our progress in manufactures, a single specimen of writing paper.

I am, dear sir,
Very truly, yours, &c.
EDWARD D. INGRAHAM.

Peter A. Browne, Esq.

On removing the points of broken drills and taps from articles of silver or brass, and of spikes from brass cannon, &c.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,—I was particularly pleased with your method of "dividing plates of hardened steel," in the last number of the Franklin Journal, and perhaps another instance of the advantage which the mechanic may derive from a knowledge of chemical science, may prove equally acceptable to your numerous readers of that class.

When Dr. Hare's compound blow-pipe was first introduced, I constructed one. In drilling the silver nozle, the drill broke at the moment it was about perforating the end, and a piece of the drill, of about one eighth of an inch in length, remained in the hole. As I had succeeded in drilling the other hole, the accident was particularly mortifying. Being unwilling to destroy the nozle, on which I had bestowed considerable labour, it occurred to me to try whether diluted sulphuric acid (oil of vitriol) would not dissolve the broken part of the drill. For the experiment, I, at night, put the nozle into a wine glass, covered it with water, and added sulphuric acid by drops, until I perceived a succession of globules of gas arise from the hole, and left it until sun rise next morning, when I had the satisfaction to find the steel entirely dissolved, and with a fine pointed punch I finished the orifice of the nozle.

This winter, I had occasion to turn three brass balls, one inch in diameter, and which were tapped half an inch deep. As I am not a professional mechanic, I from a deficiency of tools, often find it necessary to make one tool answer as many purposes as I can, and on the present occasion, finding I could centre the tap, with which I screwed the balls, in a chuck, I undertook to turn them on that, as a substitute for an arbor. With care, two were finished; but with the last, I suffered the turning tool to catch one of the corners of the square part of the tap, and broke it off even with the circumference of the ball. As I had a pressing occasion for the ball, and had no other cast, I immediately put it in the bottom of a broken oil flask, covered it with water, and added about one sixth part of sulphuric

acid, (oil of vitriol,) and placed the capsule on a stove, with a handful of ashes interposed as a substitute for a sand bath: other business requiring my attention, I did not examine it until after three or four hours, when I found the tap entirely dissolved without the least injury to the threads of the screw.

I think it probable, that the above method would be found sufficient to unspike brass cannon, and thus supersede the necessity of re-melting them, or of spoiling the touch-hole in the ordinary way of drilling. For this purpose a flat bar of wood, three or four feet longer than the gun would be required. At the distance of the touch-hole from the back of the chamber, place on the wooden bar, a lump of fat-lute; bees-wax, made soft by an admixture of oil; a cone of lead to enter the touch-hole, or any other substance which would resist the action of sulphuric acid. By using the lower edge of the muzzle of the gun as a fulcrum, and depressing the projecting end of the bar, the lute would cover the touch-hole, or the cone enter the same, and render it sufficiently tight to prevent any liquid passing down. A cup, of wax, should then be raised around the touch-hole on the outside of the gun, of sufficient capacity to contain a pint, or more, of diluted sulphuric or muriatic acid, and if the experiment were made in a temperate atmosphere, I think the gun might be rendered serviceable without any other injury than it received from driving the spike.

H. W.

Observations upon Rail-roads. By E. HAZARD, *Civil Engineer.*

TO THE EDITOR OF THE FRANKLIN JOURNAL.

DEAR SIR,—When travelling upon some of the rail-roads in England, I noticed that the wheels did not appear to bear hard against the sides of the rails, even where there were short turns in the road. This led me to an examination of the cause, which, as I have not seen it mentioned in any publication on the subject, I will now state. The wheels of the carriage are wedged on the axletree at such a distance apart that there may be an inch play between the flanches of the wheels, and the rails. The journals, or round parts of the axletrees, are an inch longer than the brass boxes in which they work, so that the axletree may move an inch endwise, before the shoulders come in contact with the box which is attached to the wagon body.

These two circumstances are sufficient to prevent the lateral friction, where the road is nearly straight; but, in addition to these, where the road winds considerably, the rail farthest from the centre of the curve is placed *higher* than the other, the middle of the curve being the highest point, and from that gradually descending both ways, till it becomes level with the other rail at each extremity of the curve. The consequence of this is, that the load, as the road bends, slides on the axletree towards the centre of the curve, and when the box comes in contact with the shoulder of the axle, assists the exterior rail in turning the wagon from the direct line; so that the rail in fact has only to throw the axle over, without any part of the load.

On the Hetton rail-way, they are *abandoning the locomotive engine.* The jarring occasioned by the wheels passing over the ends of the rails, although apparently trifling, is found to destroy the joints so fast, as to make it cheaper to maintain *stationary* engines at two miles distance from each other, with ropes extended between them, to draw the wagons. The buildings for some of the stationary engines were erected when I was there. The locomotive-engines on this road were furnished with the pistons mentioned by Mr. Strickland, which were intended to operate as *springs* to prevent the jar; but, upon close inspection while the engine was travelling, I am convinced they did not move. Indeed, it appears to me, that if they did operate at all, it would be injuriously, since the connecting rods will always be carried by the crank pins to a given point, and if the boilers with the cylinders attached to them, were raised by the small pistons from the axletrees, the connecting rods would thereby be rendered too short to pass the dead-centres, which must infallibly derange some of the machinery.

On the Fawdon rail-way, the wagons were moved, in part, by stationary engines with a rope extended between them. The rope is placed in the jaws of a vice attached to the wagon, where it is secured, and alternately wound up on drums by the engines at its extremities; its length was that of double the distance between the engines. Where the rail-way crossed a public road, the rope was bent down by friction rollers, and carried under a plank bridge, to the other side of the road, where it again rose above ground. When the wagon comes to the public road, the boy who rides on it, releases the rope from the vice; the velocity of the wagon carries it over the road, and the boy again hooks up the rope into the vice, while the wagon continues its motion.

By declining the use of locomotive engines, a great proportion of the expense of the rail-way may be saved, since wagons carrying from one and a half to two tons, can be used with as good economy as those of larger burthen, and they would require a rail-way of only one-fifth the strength of those on which steam engines are to travel.

It does not appear to be decided whether cast or wrought iron rails, are to be preferred: the former are used on the Fawdon, the latter on the Stockton and Darlington rail-way, and at each they speak most favourably of the kind they have adopted. I saw some of each which were said to have been in use for a number of years; both appeared to wear equally well, the original surface being still visible in each. The length of the wrought iron rails was certainly objectionable, both on account of the *expansion and contraction* of the metal, and the difficulty of obtaining an *equal bearing on all the props;* only a small proportion of which, were in contact with the rails I examined. To remedy this, they propose, in future, to cut the rails in two, at each prop.

I am decidedly of opinion, that in this country a rail-way of wood, sheathed with iron, would be preferable to any other, and could be kept constantly in order at the least expense. The preparation of the ground to receive the rails would be the same in any case; the

labour in laying down the rails very nearly the same, but the *materials* would cost but about one-fifth as much as the iron rails and props. On the plan adopted in England, each prop rests on a detached stone, or, in many places, a block of old ship timber. These stones, or blocks, are of *irregular form and size*, and the cast iron prop is rarely placed on the *centre of bearing or bed* of the stone, or block; the consequence is, that the weight passing over them, *sinks* them unequally into the ground, and gives them a *rocking* motion, which requires the *constant* labour of ramming them up with a bar of iron, to bring the rails level, and parallel to each other. Severe frosts would also derange them by operating unequally on foundations of different textures. In the wooden rail-way, *sills*, *embracing both rails*, would be substituted for the stones and props, and the whole would form a *connected frame*, which would reduce the action of the loads to a perpendicular pressure, which can easily be sustained. The construction is so simple that any particular piece can be taken up and replaced, as it *decays*, with as little detention as *the stones* on the other plan can be put in order; and the interest of the difference of the cost, will defray the expense. The wear of the iron sheathing will be so trifling that it may be considered nearly as a permanent fixture.

Should you deem the above remarks likely to throw any light on the subject of rail-ways, you are at liberty to make any use of them you may think proper.

Your obedient servant,
ERSKINE HAZARD.

Philad. March 27, 1827.

Method of restoring Wine that has been turned.

A METHOD has been in practice for some years, to restore wine that has been turned. The process consists in adding from half an ounce to two ounces of tartaric acid of the shops, to a hectolitre of wine, (about 26 galls.) according to its state of decomposition. The tartaric acid reproduces the tartar, disengages the carbonic acid, and, consequently, destroys the alkaline character given to the wine by the sub-carbonates.

The agricultural Society of Bourges has frequently repeated this experiment; but it has not always succeeded. They, however, ascribe this uncertainty to the impossibility of determining the exact quantity for every case. [*Bull. de Sc. Tech.*

Colouring Matter of Wine.

IN an Italian publication called "Annals of Technology, Rural and Domestic Economy, Arts, Trades, &c." is a paper by a Dr. Lomeni, on the causes of the fading of the colour of wine made in closed vessels, with a description of a kind of bellows by which that

injurious effect may be obviated. Dr. Lomeni considers it an undeniable fact, that wine made in close vessels has less body, colour, and aroma, than wine made in the old method; but maintains that by means of the motion produced in the wine by the apparatus which he has invented, the advantages of making wine in close, and making it in open vessels, may be united.

Brome, a new substance, supposed to be simple.

M. Balard, a chemist of Paris, has discovered a new substance in sea water, to which the name of *Brome* has been given. It exists in sea water, in the form of hydro-bromic acid, combined, in the opinion of M. Balard, with magnesia. It is present, however, in very small quantities. It is obtained by adding chlorine to the bittern, which remains after the muriate of soda has been separated from sea-water by evaporation, an orange coloured tint is produced, and on heating the mixture to the boiling point, the red vapours of brome are expelled, which may be condensed by a freezing mixture.

At common temperatures brome is liquid; its colour by reflected light is blackish-red, but when light is transmitted through a thin stratum of it, the colour is hyacinth-red. In its properties it appears to be intermediate between chlorine and iodine; its odour resembles the former, is very disagreeable, and its taste powerful. It is highly destructive to animals; one drop of it, placed upon the back of a bird, having proved fatal.

In the elaborate memoir of M. Balard, he has given a detail of the habitudes of brome, in its relationship to other substances; this memoir was referred to a commission of the French Academy, consisting of MM. Vanquélin, Thenard, and Gay-Lussac, who speak in high terms of the merit of the memoir of M. Balard, and, although they do not think that he has proved that brome is an elementary substance, they yet deem it very probable.

Substance that inflames upon contact with water.

At Doulens, near Amiens, is a large manufactory for spinning cotton, which is lighted by oil-gas. This gas upon its return from the cast iron cylinder, filled with red hot coal, where it is formed, traverses a reservoir of oil, in which it deposits a white liquid matter, which can be taken away by means of a spigot, situated at the lower part of the reservoir. The workmen employed in this duty, having dropped some of it to the ground, upon water, it appeared to be all on fire. The proprietor of the factory, intends to send a bottle of this singular substance to M. Gay-Lussac, to have it chemically analyzed. [*Bull. Univ.*

Domestic Manufactures in Massachusetts.

Boston, March 15.

The exhibition of home manufactured articles in the chambers of New Market House, on Tuesday and Wednesday, was fully equal to the anticipations of our citizens. There was a great variety, and most of the articles were of a superior kind.—The broadcloths, cassimeres, flannels and sattinets were in great quantities. But there was not so large an amount of superfine broadcloths as in October last. Of cotton goods, sheetings, shirtings and printed calicoes, there was also an extensive assortment. Some of them very fine; and the colours and figures of the prints very good. Articles of glass ware and cabinet furniture were numerous; and some fine ware in imitation of China were offered.—There were likewise, great quantities of wool, leather and shoes. The sales, we understand, were generally made at fair prices—and the plan, thus favourably began, will probably be prosecuted on future occasions, with equal spirit and enterprise.

Writing Pens.

The ancients were unacquainted with the fitness of quills for the purpose of writing. They chiefly employed tablets covered with wax, on which they engraved the characters with a metal style, and when they wrote with liquids on parchment, or on the paper then manufactured from the Egyptian papyrus, they made use of reeds. It has been supposed that quills were made use of for writing as early as the fifth century; but the conjecture rests merely on an anecdote of Theodoric, King of the Ostrogoths, who, being so illiterate, that he could not write even the initials of his name, was provided with a plate of gold, through which the letters were cut; and this being placed on the paper, when his signature was required, he traced the letters with a quill. The earliest certain account of the modern writing pens, dates no farther back than 636; and the next occurs towards the latter end of the same century, in a Latin sonnet to a Pen, composed by Adhelm, a Saxon author, and the first of his nation who wrote in that language. After that period, however, there are numerous proofs of their having been very generally known; but they were so far from having at once superseded the use of reeds, that persons well versed in manuscripts affirm, that the latter were commonly used in the 8th century. Reeds are still employed to write with by many of the eastern nations. We learn, from the voyages of Chardin, Tournefort, and others, that they are small hard canes, about the size of large swan-quills, which they cut and slit in the same manner that we do quills, except that they give them a much longer nib. Had the ancients been acquainted with the art of employing quills for writing they would probably have dedicated to Minerva, not the owl, but the goose.

LIST OF PATENTS IN ENGLAND.

Which passed the great seal in December, 1826.

To Thomas Machell, in the county of Middlesex, surgeon, for his invention of certain improvements on apparatus applicable to the burning of oil and other inflammable substances—Sealed 8th December.

To Robert Dickenson, in the county of Surrey, in consequence of a communication made to him by a certain foreigner residing abroad, he is in possession of an invention for the formation, coating and covering of vessels or packages, for containing, preserving, conveying and transporting goods, and products, whether in liquid, or solid forms, and for other useful purposes—8th December.

To Charles Pearson the younger, of Greenwich, in the county of Kent, Esq.; Richard Witty, of Hanley, in the county of Stafford, engineer; and William Gillman, of Whitechapel, in the county of Middlesex, engineer, for their having invented a new or improved method or methods of applying heat to certain useful purposes—13th December.

To Charles Harsleben, Esq. in the county of Middlesex, for his invention of machinery for facilitating the working of mines, and for facilitating the extraction of diamonds and other precious stones, gold, silver, and other metals, from the ore, the earth, or the sand, which machinery is likewise applicable to other purposes—13th December.

NOTICES.

The last number of Silliman's Journal contains a "Vindication of the Memorial on the upward force of fluids, by E. C. Genet." As this Vindication was written before the appearance of our remarks upon the Memorial, in our number for January, and is principally devoted to the notice in the Boston Journal of Science, we think that it would be premature to resume that subject. We may hereafter, when in a quixotish mood, again embark on board a *Hydronaut*, or accompany the flying fish *Æronaut*, into the upper regions of sublimated imagination.

The communication of C. P. upon the subject of the Chess Player, was not received in time for our last number; his remarks may be used at a future day.

An article upon Friction, intended for the present number, has been unavoidably postponed, but will appear in the next, when F. will see that he has not been forgotten.